MOTOR TRUCK TRANSPORTATION

THE PRINCIPLES GOVERNING ITS SUCCESS

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PREFACE

In 1903 there were no motor trucks. In 1904, there were 411 produced. Seven years later, or in 1911, the yearly production had grown to about 11,000; while last year (1920) 335,000 motor trucks were manufactured. Thus, the industry is only fifteen years old, and it has made its greatest strides during the last five years. There are today about 900,000 motor trucks in service.

The great war is perhaps more than any other factor responsible for this. That conflict, in which so much depended on transportation, both "over there" and "over here," proved beyond a doubt the reliability and utility of the motor truck. It is now used in every line of industry.

The motor truck has demonstrated its dependability as a mechanical device. That it can be an economical means of transportation has also been proven. Its further use depends not so much on truck mechanics and design as it does upon a knowledge of how the truck can be utilized and upon a conception of its place and possibilities in the transportation system of the country.

But the field of usefulness of the motor truck cannot be extended to its full extent unless the principles governing its most successful utilization are generally understood. Ignorance is the one factor that may prevent the new method of transportation from becoming a cogent element in economical distribution: a vital element, because in many instances it is the cheapest method as well as the most efficient, for haulage.

This book is not a technical treatise on motor trucks themselves, but a practical presentation of the principles of truck operating cost; operating efficiency and cost records; operating cost laws; truck details, such as bodies, loading and unloading devices, trailers and semi-trailers and pneumatic

tires; maintenance; and factors that determine the economical operating fields.

The book therefore contains no intricate diagrams, charts, tables, curves, formulae, examples, and technical terms. Actual photographs are used to illustrate the main points. The author does not attempt to discuss truck design, construction or manufacture. He accepts the motor truck as a demonstrated mechanical device and considers those principles of which a knowledge will lead to the most economical and efficient use of the truck.

Transportation is so essential in the life of a community or nation, that anything that will extend it, cheapen it, and make it more efficient should be given consideration.

The purpose of this book is therefore by a brief yet simple and logical arrangement, and by a low price, to make available to as many as possible, a knowledge of the principles that govern successful motor truck operation. It is intended to be helpful to user, shipper, transportation man, purchaser, student, economist and seller, or to anyone having a special problem in hauling, delivery, distribution or transportation.

In presenting to the public a work of this kind on motor truck transportation, acknowledgment must be made of the vision of Emlen S. Hare, now President of Hares Motors, Inc. In his career in motordom, Mr. Hare has perhaps, more than any one man, been responsible for the insistence upon the sale of motor truck transportation rather than merely motor trucks.

F. Van Z. Lane.

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CHAPTER I

The Future of the Motor Truck

The motor truck will eventually haul practically all of the freight going over the streets and highways, most of the short haul less-than-car-load rail freight and part of the long haul less-than-car-load freight now being hauled by the railroads. Designed as a motor bus, it will also handle a considerable percentage of the urban and inter-urban passenger traffic. Some of the factors which will make it possible for the motor truck to do this work are the following:

1. More good roads.
2. Growing realization of shippers of the importance of the delivery part of the business.
3. Realization by shippers of the economical value of the motor truck.
4. Elimination of street congestion.
5. Appreciation of the fact that the motor truck is more economical than railroads for short haul less-than-car-load in heavy traffic territory.
6. Recognition of the principle that the motor truck is more economical than railroads in light traffic stub-end territory.
7. More extensive use of the truck by farmers.
8. Development and use of loading and unloading devices.
9. Development of special bodies and special equipment.
10. Further development of pneumatic tires.
11. The perfecting of maintenance, despatching, routing, and shipping room methods.

12. Increasing use of the motor bus in passenger transportation.

13. Improvements in chassis and engine design and construction.

14. Increasing interest in and general understanding of motor transportation engineering.

1. More Good Roads.—The highway is to the motor truck what the track is to the railroad train. Without a track of adequate strength and dimensions it would be impossible for our railroads or electric railways to operate with the degree of efficiency that they now realize. As the weight, size, and speed of cars, trains and locomotives have increased, so also have the weight, size and strength of the tracks been increased, and tracks have been maintained with more care. Furthermore, without a sufficient number of adequate tracks the railroads of this country could not begin to serve the important points. No matter how many railroad lines we have, their inflexibility of cost is such that they will not perform transportation service in its entirety. We must still look to the highways.

The efficient type of highway rolling stock has already been developed, but the right type of road bed for it, in sufficient mileage, is lacking. All signs point to a tremendous increase in good roads construction, and with good roads the use of the motor truck will increase tremendously. The argument that the highway should be the servant of transportation, not its master, is beginning to bear fruit, and we are beginning to see that in order to make our transportation system, as a whole, serve more economically, the use of the motor truck must be seriously considered, and this in turn necessitates the consideration of the whole question of road construction.

There are today approximately 2,200,000 miles of public road in the United States, of which only 156,000 are at all improved. One quarter of one percent of the total road mileage, or less than 6,000 miles, is so constructed as to be

capable of sustaining heavy road traffic. If the motor truck has developed to the extent that it has under these road conditions, are we not justified in claiming that as good roads are built there will be a tremendous increase in the number of trucks needed and placed in operation?

The National Government is now committed to highway construction. Congress has voted millions of dollars for use in federal aid toward the construction of state highways. There is already available this year, from state, county and other sources, about $600,000,000 for highway construction.

A bill providing for a national highway system has been introduced in Congress. It contemplates federal maintenance as well as construction, and uniform traffic laws, and will undoubtedly be passed sooner or later. It is receiving almost universal support.

Not only is the demand for more good roads sweeping the country, but there is a related and equally widespread demand that roads be made heavier, wider and smoother. With such roads motor trucks can be operated more economically and more efficiently, because greater speed can be obtained, the cost of truck up-keep decreased, less fuel will be required because of the better traction afforded, and trucks will last longer; all of which means that trucks will be more and more in demand.

2. Growing Realization of the Shipper that the Question of Delivery is of Primary Importance in the Success of his Business.—Most concerns know pretty well just what their labor, production, selling and accounting costs are. The head of the concern has usually had experience in these branches of the business. They have also had the attention of students of economics. On the other hand, the head of the concern has usually had little or no transportation experience; and those in his employ, in charge of such matters, have often succeeded in conveying the impression that transportation technique is something highly mys-

terious. Consequently, the only attention that the chief executive has paid to shipping has usually been merely to see that deliveries were made; and not *how* they were made. The fact that very few concerns use delivery cost systems proves this.

In the business of transportation or hauling itself, perhaps a little more attention has been paid to transportation means and methods, but here again knowledge of costs is lacking. Prices are often quoted without any definite knowledge as to whether or not the work can be done at the figure quoted.

As the cost of doing business rises, closer analyses of all cost elements are constantly being made; and as the motor truck manufacturers are continually pointing out economies that can be effected in delivery systems, the shipper is fast learning that there is room for choice between several methods in every problem of shipping and delivering and that it will be to his interest to look into them all in a comprehensive way.

3. Shippers are Realizing the Economical Value of the Motor Truck.—The more the shipper investigates his transportation problem, the more convinced he is bound to be that the motor truck will fit into it at some point. He will see that it can do more work with less cost, and be more dependable, than horses. He will see that for short hauls it is quite as cheap as the railroad, even on the basis of railroad rates and motor truck operating costs alone; and when he begins to analyze the railroad phase of the problem further he will find that by using the truck he will realize a saving at many other points, as will be demonstrated later.

He will find that if compared directly with express rates the truck is very much the cheaper. From the standpoint of time he will find that it is the fastest means of transport for short distances in all but extremely congested districts: and he will eventually realize what this time means in

actual saving of dollars and cents, and the many ways in which the saving will help him to increase his business.

He will find that the motor truck adapts itself to labor-saving devices in loading and unloading and that through routing and dispatching methods, hard to establish with other transport equipment, he can keep better track of his deliveries and, therefore, render better service: and he will be able to determine more exactly what his shipping costs are.

The use of a type of transportation determined by systematic analysis is becoming more and more general; and eventually all transportation methods will be applied on the basis of such analysis. Because of this single factor, the motor truck is going to find a constantly increasing market.

4. Elimination of Street Congestion.—Many possible uses are denied the motor truck today because street congestion prevents the truck from operating with any degree of speed. In many sections of such cities as New York, Chicago, Philadelphia, Boston, etc., street congestion exists to such an extent that the motor truck cannot be used to the greatest advantage, and the sections in which such congestion, from a trucking standpoint, is the greatest, are often those to, through, or from which the greatest amount of freight is hauled.

If this congestion can be eliminated or reduced, possible use of the motor truck will be greatly increased. Substantial progress is being made in this direction.

People are becoming more and more impressed with the fact that when the cost of delivery at terminals and through the streets is greater than that of the long haul to the terminal in the city, the cost of living is adversely influenced. The cost of transportation is a large part of the cost of any article. Street congestion means high prices.

More and more is being done in this direction as con-

ditions and their remedies are being shown up by City Plan, Street Traffic, Railroad, Harbor and other Commissions.

Such Commissions are at work now in most of our large cities and they are not only endeavoring to remedy present conditions but to plan so that congestion will not occur in the future.

Thus we have new relief streets cut through, old roadways widened, streets used for one-way traffic only, parallel street pavements improved, street obstructions eliminated, tunnels and bridges built to separate traffic, street traffic regulations established, etc.

One of greatest factors in speeding up such work is the growing realization on the part of all that the motor truck offers an economic means of transportation and that conditions should be made such that the motor truck can be utilized effectively.

5. Growing Realization that the Motor Truck is More Economical than Railroads for Short Haul in Heavy Traffic Territory.—The haul which is profitable to railroads is the so-called long haul. Short haul is not very profitable, if profitable at all, because the terminal expense incidental to any haul cannot be absorbed by the short haul. So great has this terminal expense become that, only recently, one of the Interstate Commerce Commissioners has rendered an opinion stating that in his judgment terminal and haul rates should be separated.

Mr. Grosvenor M. Jones of the Bureau of Foreign and Domestic Commerce, United States Department of Commerce, is authority for the statement, "It has been estimated that the average expense of hauling a ton of freight 240 miles in the United States is 74c while the expense of handling the same ton of freight at the terminals is 75c."

Another authority states that it costs 27c a ton to move package freight from New York to Philadelphia on the line and that the terminal expenses are $3.65, or nearly

fourteen times as much. Philadelphia is 90 miles from New York.

Mr. John F. Wallace, when Chairman of the Chicago Railway Terminal Commission and a noted railroad engineer, stated: "The average freight train spends twelve hours in the terminal for every hour it is on the road."

A comparison of rates between the motor truck and the other existing forms of transportation between short haul points will be in favor of the motor truck. The same comparison is also in favor of the truck with respect to time. For instance, from New York to Philadelphia, a distance of 90 miles, the first class railroad less-than-car-load rate per 100 pounds is 46c; add cartage costs 30c; total freight rate 76c; time several days. Express rates per 100 pounds are $1.45, time two days. Motor trucking per 100 pounds is 85c to $1.00 and the time overnight.

Detroit to Toledo, first class boat rate per 100 pounds	$.45
Detroit to Toledo electric railway rate	.52½
Detroit to Toledo steam railroad rate	.52½

To all of these rates there must be added 20c to cover haulage to and from each of the lines, thereby making the boat rate 65c, the electric railway rate 72½c, and the steam railway rate 72½c. The express rate is $1.03, the motor truck rate is 60c, and in lots of 3 tons or over, only 40c.

The motor truck makes the run in a few hours, whereas it takes a day or more where the other means of transportation are used. There are many other points in favor of the motor truck for such traffic, besides the lower rate and quicker time.

In the use of the motor truck it is frequently unnecessary to pack the goods. There is therefore a saving in labor and material expense due to packing and also in the weight of the packing which adds to the total freight rate because it adds to the total weight of the article shipped.

Goods are less liable to damage because there are but two handlings as a rule, one on to the truck and one off

of the truck, whereas by any other method there are several handlings. These handlings take place outside of the jurisdiction or supervision of the shipper. For

Meat freight rates are cut in half between Detroit and Toledo, a distance of 65 miles, and the time of delivery materially reduced by the use of this refrigerating truck which is in daily operation. Sometimes a trailer of the same construction is attached.

this reason, the volume of goods damaged by railroads is surprisingly large and it takes a long time to put claims through. Goods are very infrequently damaged when handled by motor trucks and if there are claims, they can be settled immediately.

One motor trucking concern operating between Detroit and Toledo handled 5000 packages with but three damage claims.

Because of the saving in time resulting from the use of the motor truck there is no loss of interest. Merchandise is usually billed the day it is shipped. Merchandise costing $5,000 lays in the freight car for two weeks (this is the rule rather than the exception), and the purchaser meanwhile undergoes an interest charge of $11.50. The motor

truck enables a business concern to carry less stock than would otherwise be necessary and therefore decreases the amount of capital tied up. When merchandise stocks are low the buyer can replace them very quickly. Some concerns pay on a 2%—10 day basis, or similarly, and if the goods arrive the day following the order, via motor service, the dealer will have nine days' time in which to dispose of them, and take advantage of the ten day discount. With truck deliveries, there is the possibility of selling goods before payment is due. With ordinary deliveries, the possibility exists of having to pay for the goods before they are received, if they come by freight.

Thus it will be seen that as we analyze this situation the motor truck appears in a more and more favorable light. As the railroad short haul traffic runs up into the millions of tons, it will be seen that the possibilities for the use of the motor truck in this field are tremendous.

6. Growing Realization that the Motor Truck is more Economical than Railroads in Light Traffic Stub-End Territory.—That the railroad of the future may find it more economical to tear up short line tracks and develop motor truck transportation in place thereof was the forecast made recently (January 16th, 1919) in an address on the future status of the railroads by Mr. C. A. Morse, Assistant Director of Operation, in charge of engineering and maintenance, for the U. S. Railroad Administration. Mr. Morse delivered his paper before members of the New York Railroad Club and his remarks were followed with close attention as coming from one of the best known railroad men in the country.

"The perfection of the motor truck and tractor together with the universal use of the automobile, have introduced a new element into the transportation problem that should be taken into consideration at this time, while studying the reorganization of the whole transportation question," said Mr. Morse.

"Good roads are demanded for the use of the automobile and a study should be made to see what additional expense would be necessary so to construct them that they would serve for motor truck and tractor. Where, heretofore, development of the country for 50 miles either side of a trunk line of railroad has required the construction of light branch lines, it is a question to be seriously considered whether this policy should be continued or whether good wagon roads should be constructed and the products of farms, and passenger travel, should not be handled by motor trucks, and automobiles, to the main line.

"Taken alone and considered as a unit practically none of these small branch lines pays expenses; but as gatherers of freight and passengers to increase density of traffic on the main lines they are sources of profit.

"As, however, the traffic gathered by them is turned over to the main line with a deficit attached which has to be overcome during the main line movement before any profit is made, it would be a decided advantage if this traffic could be delivered to the trunk line by means of the motor truck, tractor and automobile without this bill of expense attached."

Noting the fact that a handling would thus be obviated since it is now necessary to truck farm products to the short line branch, and then to transfer them to the main line, Mr. Morse continued:

"Investigation of this subject may show the desirability, as good roads are completed, of the taking up of many branch line railroads and utilizing the abandoned road bed for an improved motor road, thus decreasing the expense of maintenance and operation of our railroads and giving in its place a well located motor road. Such a change would call for increased facilities at stations along the main line for passengers and for hauling freight, including storage, trackage, etc., but it would mean the concentration of

supervision and labor, permitting better housing and living conditions for employees.

"Motor driven conveyances have gradually been changing conditions of railroad transportation for the past ten years, and now that the general study of transportation facilities is up for discussion, they should be taken into careful consideration, and due weight given to their influence on the economics of the situation."

7. More Extensive Use of the Truck by Farmers.—Mr. Hoover said, "50 per cent. of our perishable food stuffs never reach the consumers because the farms on which they are raised are too remote from the market at which they are sold.

"40 to 60 per cent. of our potato crop is lost each year by rotting in the ground owing to poor transportation means or to spoiling on the way to market because of inadequate transportation over long distances.

"By motor trucks the farmer will be able to reach better markets farther away than now by horse and wagon. He will be able to spend more time actually producing on his farm and be able to sell food more cheaply by eliminating the present tremendous waste. By use of the motor truck the farmer will be able to produce more and sell at less cost."

Former Secretary of Commerce Redfield recently said, "You might build up the railroads until they are ten tracks wide and fill the rivers with steamers, and still the farmer could not be served."

The present staggering economic loss occasioned by the waste of food production can and will be eliminated by the motor truck. This will be brought about in at least four ways:

1. By motor trucks owned and operated by the farmers.
2. By co-operatively owned trucks where one truck is sufficient to serve several small farmers in the same locality.

3. By the establishment of regularly operated truck lines carrying food products at a regular scale of prices.
4. By the rural post trucks of the Post Office Department.

It was not until 1918 that the trucks began to be used in any number by farmers.

The Bureau of Crop Estimates of the U. S. Department of Agriculture reports that the cost of hauling in wagons from farms to shipping points in 1918 averaged about 30c per ton-mile for wheat, 33c for corn and 48c for cotton. For hauling in motor trucks, corresponding averages were 15c, 15c and 18c.

Motor truck hauls in 1918 from the farms to the shipping points averaged 11.3 miles, while wagon hauls averaged only 9 miles. The motor truck, however, made on an average 3.4 round trips per day over its longer route of 11.3 miles, while wagons made only 1.2 round trips per day over the 9 mile distance.

Shortly, for the modern farmer, the problem will narrow itself merely to the choice of the proper truck; the utility and value of motorizing the farm industry will be definitely and firmly established. The characteristic foresight of the American farmer will bring this about when he realizes that one truck on his farm will release several horses, that one horse requires five acres of tillable land to support it,—land which should be raising valuable food stuffs required for human consumption;—and that by the use of motor trucks, the farmer can haul to market while keeping his horses working in the fields; and that the motor truck will bring land formerly too far from market for profitable farming, into good use. One authority has stated that the farmers of this country will need at least two million additional motor trucks within the next ten years.

8. Development and Use of Loading and Unloading Devices.—Probably the longest delays occurring to a motor truck are at the loading and unloading points. Sometimes

these points are at the shipper's own platform where he has control. Sometimes they may be at a freight station or a warehouse where he does not have control.

The motor truck operator is beginning to see that speed in loading and unloading affects, to a great extent, the profits to be obtained from motor truck operation; and as a consequence, many unique loading and unloading devices have been developed, and are being utilized, but as yet only to a limited extent. Among them may be mentioned winches, hoists, gravity shoots, conveyers, cranes, telpherage systems, demountable bodies, nest bodies, hampers, etc.

More thought and application is being given and will be given to this phase of motor truck transportation than ever before, and as a consequence, the truck will be better served in this respect as time goes on. As these loading and unloading devices develop and are made use of, so then will the truck be more efficient and in greater demand.

9. Development of Special Bodies and Special Equipment.—Along with speed, the load is the other important factor by which truck efficiency is measured. A truck carrying only part of its capacity is not working as hard as it might. Sometimes this cannot be helped but study has proven and experience has demonstrated that very often capacity loads can be hauled if a body is designed for the special work in hand. This fact is being recognized more and more and undoubtedly the future will develop bodies in designs undreamed of at the present time, which will be better adapted to the special character of freight to be hauled.

Special equipment, such as pneumatic tires; more comfortable provision for the driver; equipment adapted for street cleaning, fire fighting and snow removal work; all these are continually being developed. The use of trailers and semi-trailers will make the truck a more desirable and economic means of transportation in many instances.

All such developments and special bodies will make the

motor truck more efficient and will consequently increase the demand for it.

The study of special equipment will also afford to the truck a greater degree of adaptation to new business and new uses.

10. Development of Pneumatic Tires.—The functions of tires on motor trucks are to secure traction, to protect the mechanism and the load, and to save the road as much as possible. Obviously the better a tire can perform these functions, other conditions being uniform, the greater will be the speed at which the truck can travel. As speed is an important element, anything that will enable the truck to operate faster and still function as above, must make the motor truck more available.

Although pneumatic tires are yet somewhat in the experimental stage, enough is known about them in practical operation to know that increased traction can be obtained with them; they give better protection to the mechanism and the load, and they probably injure the road less, than do solid tires. Because of the last two points, greater speed is obtainable and so the usefulness of the truck is extended because of the additional distance it can travel in a day. Because of the first function, that is because pneumatic tires afford greater traction, the truck can be used on roads under severe weather conditions where it would be impracticable to use solid tired trucks, thereby permitting the application of the truck in places or for services where it could not otherwise be used.

It is claimed that pneumatic tires also lower repair bills and save gasoline. This is somewhat debatable, and if true, such saving may be offset by the fact that pneumatic tires cost more to purchase and maintain.

11. The Perfecting of Maintenance, Dispatching, Routing, and Shipping Room Methods.—It is only now being realized that the use of better maintenance, dispatching, routing and shipping room methods will keep the truck going faster with capacity loads, more of the time.

Maintenance methods are now being studied and applied from the standpoint of keeping the truck moving, as well as from that of reducing the cost of actual maintenance.

Proper dispatching will enable a truck to get away quicker and proper routing will cover the same delivery points with a shorter mileage, with less wear and tear, and with more nearly capacity loads.

In considering these things, the shipper will realize that shipping room methods in general have a good deal to do with them, and shipping room methods will also receive detailed study and consideration, with the result that maintenance, dispatching, packing, routing, billing, invoicing, etc., will all be co-ordinated to the end that the truck may be served better. When this is done, the truck will do more work and will be in greater demand.

12. Increasing Use of the Motor Truck Designed as a Motor Bus, in Passenger Transportation.—Motor trucks designed as motor buses are more and more coming into use as means of passenger transportation. The motor bus, because of its economy, flexibility and dependability, is rapidly making a place for itself for urban and inter-urban passenger transportation. It is particularly adaptable for congested and narrow streets or thoroughfares where it is not desirable to instal permanent structures. It is a means for supplementing or serving other means of transportation to and from districts not very heavily populated.

Motor buses, where properly operated, that is, on regular schedule, with equipment designed to carry the traffic presented, and with a sufficient amount of equipment on hand so that it can be properly inspected and maintained in order that dependable operations may take place, have proven very efficient. Motor buses are an important and reliable means of passenger transportation in most of the European cities where the scientific study of street traffic has been going on for years. The most notable example of their use in this country is in New York City where the

Fifth Avenue Coach Company operates motor buses on Fifth Avenue and Riverside Drive and other streets. In the last five years the number of passengers carried by this Company has increased from about fourteen millions per annum to more than forty-two millions per annum.

Some time ago a regularly operated line began operations on the boulevards of Chicago and this Company is said to be meeting with success. In many others of our larger cities, buses are in direct competition with street railways, operating over the same routes and in the same streets. They are under certain conditions faster than the street cars; and because of their flexibility, more buses than street cars can be operated under certain conditions of street traffic.

It is very noticeable that our Municipal and Legislative authorities are recognizing the necessity and utility of motor buses. More and more laws and ordinances are being passed permitting their use. It has been said that the motor bus saved Paris in the late World War when it rushed out that part of the French Army, held in reserve at Paris, to meet the oncoming Germans.

13. Improvements in Chassis and Engine Design and Construction.—As perfect as chassis and engine design and construction may be at the present time, we may naturally look for further refinement and improvements in these respects. These improvements will naturally make for more economy in operation, greater dispatch in repairs, and a longer life, which of course will reduce truck operating costs; which in turn will increase the use of the motor truck.

Particularly, may developments along this line be expected that will make pneumatic tires more adaptable.

14. Increasing Interest in and General Understanding of Motor Transportation Engineering.—Everything that has been said in this chapter comes under the head of motor transportation engineering, which is the art of the correct

application of the motor truck. The application of motor transportation engineering will bring about most of the uses and improvements mentioned.

The shipper is beginning to see that the question of the motor truck involves something more than merely the use of a particular operating unit. There are other factors which must be taken into consideration with this question of unit, to cover the whole question of efficiency. Shippers are beginning to investigate, and on investigation are finding, that the whole matter of transportation is involved and expensive. They are then bound to consider the availability and economy of all methods of transportation, and of course transportation by motor truck will be considered. The more the problem of transportation is studied, the more will be known about the conditions of correct application of the motor truck, and so motor truck transportation fundamental principles will be developed and generally understood.

CHAPTER II

Motor Truck Operating Cost Factors

The most important point in motor truck transportation is correct knowledge of its cost; because if cost is not known, it cannot be said with any degree of accuracy that the transportation problem can be more economically solved by using motor trucks rather than by using some other means of transportation. After it has been decided that a motor truck is the more economical to use, how can it be said that it is doing its work to the best advantage, and at the least cost, unless operating costs and performance are systematically recorded after the truck is placed in service?

The matter of estimating operating costs will be discussed in this chapter, and that of keeping account of costs and performances after the truck is placed in operation, will be taken up in a following chapter.

It is impossible to set down in this place, motor truck operating costs that will hold good for all time, in every locality, and for every operating condition. Obviously, costs will differ even with the same-sized truck, hauling the same load and covering the same distance, with different road and traffic conditions, and with different climatic conditions. And so also do costs of gasoline, oil, and materials, the pay of the drivers, and garage charges vary from time to time and in different places.

But it is possible to bring out those factors that should be considered in estimating costs, and the estimator can then supply the local current rates and prices, and allow for the local and special operating conditions.

It should be noted, however, that it is quite impossible to estimate costs correctly unless all of the factors making up the total cost are considered. It is because all of the factors entering into the operation of motor trucks have

not always been taken into consideration, that many users of this means of transportation have not fully profited by its use and have misled themselves and others as to the actual cost. This is also true with other means of transportation, and in determining the economic place of the motor truck in the whole transportation system, all of the cost factors under other means of transportation should also be considered.

Motor truck operating costs may be divided into three headings, Investment Costs, Fixed Costs and Variable Costs, and these again sub-divided into the following items:

Investment	*Fixed*	*Variable*
Chassis	Interest	Fuel
Body	Insurance	Lubricants
Cab	License	Maintenance
Freight	Driver's wages	Tires
War Tax	Garage rent	Sinking fund
Special equipment		

Under Investment should be considered all items entering into the original cost of the truck. It is necessary to know this amount so that interest can be computed, and so that a sinking fund can be set aside. Interest is based on the total amount of the investment over a period equal to the life of the truck, and the total amount less the tire value together with the life of the truck in miles is taken as the basis for the sinking fund. Experience has shown that with reasonable care any good make of truck will last at least 100,000 miles, and so it is usually safe to assume this life period; and for estimating purposes this life divided by the yearly mileage, will give the number of years on which the interest is based.

When the price of a truck is announced, it is usually for the chassis only, and includes the tires. To this chassis must be added the body, cab, and special equipment, and their cost must be added to the chassis cost. For sinking

fund purposes the tire cost is deducted, as this is taken care of under variable costs. Tires are usually guaranteed for a certain mileage, so that their daily cost, depends on the daily mileage of the truck. The price of the chassis is always quoted F.O.B. factory, so that the freight cost must be added by the purchaser even though he purchases the truck directly from the floor of the agent. As with other commodities, the consumer must pay the war tax; and there is one on motor trucks.

Driver's cabs have not as yet been generally adopted as standard equipment, as they are not always used, and so are usually an extra. Special equipment means such equipment as self-starters, electric lights, tire pumps, draw bar devices, cranes, etc. which are not generally standard, and are not included in the chassis price as a rule, and which may be considered as special and extra, supplied if desired by the chassis manufacturer, or by someone else, depending on facilities, etc.

Under Fixed Costs, are included all of those cost items which go on whether or not the truck is in actual operation. These are usually reduced in the first instance to a daily basis. We have already seen how to estimate the interest charge. Liability, property damage, fire and theft, should all be considered in reaching a proper insurance cost. There is no standard license fee; it differs in the different states, and may also vary with the rated capacity of the truck, the horse power of the engine, the load carried, and the unsprung weight of the truck.

Variable costs are those costs which vary with the number of miles operated, and obviously if the truck is not operating at all there are no costs of this kind. Obviously too, these costs are all figured on a mileage basis, as is eventually the total fixed and variable cost. In arriving at the several costs making up the fixed and variable total, it is necessary to know what mileage per gallon the particular size and make of truck in question can realize under the existing

conditions. This is best ascertained from users in the same locality, and they can also advise what it costs to maintain the particular truck under consideration.

It has already been said that tires are guaranteed for a certain number of miles, so that a definite figure can be assumed in estimating this item.

Having reduced the fixed costs to a daily basis, and the variable costs to a mileage basis, the daily average operating cost can then be found by multiplying the daily mileage by the total variable cost per mile, and by adding to this total the fixed cost per day.

Suppose for instance, the total fixed cost is $7.00 per day, the variable cost is 12c per mile, and the truck operates 50 miles per day. The daily operating cost would then be $13.00 per day, and the operating cost per mile would be 26 cents.

It will perhaps be noted that nothing has been said about overhead costs. The costs that have been considered apply directly to operating a truck while engaged in actual transportation service. The amount of overhead to be added depends on just what part the truck plays in conducting the business as a whole and this varies so that each individual case would have to be specially considered; but for purposes of economic comparison, the actual truck operating costs alone it would seem are sufficient. The indirect overhead expense applies to all other means of transportation as well. But, and this point should be emphasized, there is an overhead cost and it should be estimated and applied in order to obtain a true total cost.

In considering fixed costs and reducing them to a daily basis, it is important to have an idea as to the number of days a year the truck will actually work. For instance, practically all items that come under the heading of Fixed Costs go on whether the truck is operating or not, and are usually calculated on a yearly basis, so that to obtain the

actual daily fixed cost, it is necessary to divide the total yearly cost by the number of days in the year it is assumed the truck will work. It is usually considered that a truck will operate every day in the year except Sundays and holidays, or about 300 days, so that the amount for the year is usually divided by this figure to obtain the true daily fixed cost.

There are some lines of business, however, in which a truck cannot possibly work 300 days a year, or every working day; for instance, in the contracting business. Weather prevents, strikes take place, material is held up, etc. Again, in other lines of business a truck may be used for very long hauls, so that it makes the run only three or four days a week. It is quite necessary too, at times, to lay a truck up for repairs, which means lost days.

For instance, the total yearly fixed charges for operating a truck may amount to $2,100, which would be $7.00 per day for a 300 year day. But suppose this truck only actually operated 200 days during the year. The daily fixed charge would then be $10.50: so that (with a daily mileage of 50 and a variable cost of 12 cents per mile) the total daily operating cost would be $16.50 instead of the $13.00 given heretofore.

It is because of the failure of many truck operators to consider this point that very frequently a daily rate is quoted which is actually less than the daily operating cost.

From what has been said it can now be easily seen that the "cost per day" depends on the daily mileage. Fixed costs are constant, so that the daily cost varies with the variable costs, and the aggregate of these depends on the number of miles the truck is operated. Obviously, the "cost per day" increases with the daily mileage. This is the reason why it is quite possible to operate a five-ton truck at a lower cost per day than a two-ton truck. The

five-ton truck may operate only ten miles a day whereas the two-ton truck may operate fifty miles a day.

We can now also see how the "cost per mile" depends on the number of miles operated per day. This cost will decrease as the daily mileage increases. We have seen how operating costs are composed of variable costs and fixed costs. A high daily mileage means low mileage costs, because there are a greater number of miles over which the constant daily fixed charges can be distributed. A six-ton truck operating fifty miles a day may be cheaper per mile to operate than a three-ton truck operating only twenty miles per day.

Because the fixed costs for all sizes of heavy trucks are practically the same, and because the variable costs on the various sizes are not in direct ratio with size, the cost "per ton" (or whatever other capacity unit is used) will depend on the truck capacity. It will decrease with increase in truck capacity. The daily cost per ton of capacity will increase if the daily mileage be increased. We have seen how the "cost per day" increases with the mileage; obviously the daily "cost per ton" or other capacity unit must also increase with mileage.

And this is all summarized in the "cost per ton mile" or "cost per unit mile." For we can readily see now how this depends on the truck capacity and the daily mileage it makes. It will decrease with an increase in capacity, or an increase in daily mileage. The "ton mile cost" will be the same for each of two three-ton trucks operating ten miles daily. It will be less with a five-ton truck operating ten miles daily than with a three-ton truck operating ten miles daily. It will be less with a five-ton truck operating twenty miles than with a five-ton truck operating ten miles.

The lowest "ton mile cost" can be obtained by operating the largest capacity truck over long distances or at high daily mileages. The highest "ton mile cost" will be ob-

tained by operating the smallest capacity truck over short distances or with short daily mileages.

Before truck performance comparisons can be made, all of the factors should be known. Without knowing these factors, daily costs, mileage costs, ton mile costs, etc., cannot be computed and it is dangerous to attempt to do it.

CHAPTER III

The Laws of Motor Truck Transportation (As Applied to Operating Costs)

In considering the factors that enter into the cost of operating motor trucks we have therefore developed what may be termed the "Laws of Motor Truck Transportation." These can be concisely stated as follows:

1. The *cost per day* will vary with the miles operated per day. This cost will *increase* as the daily mileage increases.
2. The *cost per mile* will vary with the miles operated per day. This cost will *decrease* as the daily mileage increases.
3. The daily *cost per unit* (per ton, per bag, per gallon, per bale, per box, or whatever unit is used) will vary with different truck capacities and the distance hauled. This cost will *decrease* with an increased truck capacity and it will *increase* with an increase in daily mileage.
4. The *cost per unit-mile* (per ton-mile, etc.) will vary with different capacities and the miles of truck haul per day. This cost will *decrease* as the capacity increases and it will *decrease* with an increase in daily mileage.

It is important to note that these "Laws" apply only when other conditions are equal, such as road and traffic conditions, efficiency of drivers, efficiency of mechanical operation of trucks, etc.

These "Laws" are important and should be known and thoroughly understood by everyone directly engaged in transportation and shipping, and particularly by those who are engaged in motor truck transportation as a business.

A knowledge of these fundamental "Laws" will clear up many apparent inconsistencies in comparing the cost of operating one truck with another. Such knowledge is necessary if the prospective truck operator is to determine

correctly what capacity of truck he should use. They make comparisons possible with other means of transportation, and enable the operator to ascertain his actual cost of operations in connection with the performance of his truck.

These "Laws" explain, as was brought out in detail in developing them in the previous Chapter, why it is possible:

1. To operate a five-ton truck at a lower cost per day than a two-ton truck.

2. To operate a six-ton truck at a lower cost per mile than a three-ton truck. (The six-ton truck may travel more miles than the three-ton truck. Since the fixed charges for each truck are about the same and since the difference in the variable charges is less than the difference in capacity, the fewer the miles the higher the cost.)

3. To haul a ton one mile cheaper in a five-ton truck than on a two and a half-ton truck, provided the trucks be loaded to capacity. (Since fixed charges are about the same in each case and since variable charges are not in direct ratio to the capacities of the trucks, it does not cost twice as much to operate a five-ton truck one mile as it does to operate a two and a half-ton truck.)

4. To haul a ton cheaper if the distance is only one mile than if it is four miles. (This is obvious, yet if we do not think about it, we may not consider that the hauling cost per ton varies according to the length of haul and increases with it.)

5. That the cost of hauling a ton a mile may vary. (This is possible because the operating costs of different capacity trucks are not in direct proportion to the capacities. Therefore the per ton mileage cost will be less with a fully loaded three-ton truck than with a fully loaded two-ton truck. The cost of operation per mile depends on the total daily mileage. It decreases as the mileage increases. The ton-mile cost of a three-ton truck operating twenty miles a day will be less than if the truck only handled its three tons ten miles a day.)

CHAPTER IV

Motor Truck Operating Cost Records

Having carefully determined that it will be economical to operate a truck or a number of trucks in the particular line of business considered and under the special requirements for the hauling or delivery in question, it becomes necessary to keep an accurate account of the actual costs, subdivided in such a way that it will be easy to analyze them and to determine whether all the work possible is being obtained from the truck, and whether its operating costs can be cut down.

Economical performance cannot be determined in any other way. Although a number of complete truck cost accounting systems have been devised and have been in operation for several years, and are simple, cheap, easily available, and require only a very few moments per day for the necessary records, yet their use today is very limited. There are probably less than 50,000 records being kept according to these systems out of a total of some 900,000 trucks, or only about five per cent. Of course, there are individual systems in use, yet it is doubtful if any operating costs at all are being kept on as many as eight per cent. of the motor trucks in operation.

This is a very curious situation. The business man knows what his production, labor, selling, advertising, and overhead costs are, and takes particular pains to find out, at considerable cost. Yet he usually disregards his transportation, hauling and delivery costs, although they may play a large part in the total cost of doing business. In fact, in many businesses, they are the largest single element in the total cost. This is probably because the head of the business has never been especially interested in that part of the business, and because those responsible for it have

thrown an air of mystery around it, that the management has been satisfied if the wheels of transportation kept on moving, no matter what the cost. Many of the transportation cost items have been absorbed by other departments of the business, and other items have been looked upon as a necessary evil. Simple accounting will indicate points, where economies can be effected.

A proper truck cost accounting system will show mileage per gallon of gasoline and of oil, loads carried, loading and unloading time, number of stops, time out for repairs, speed, etc. A careful analysis of these records may show that too much gasoline and oil is being consumed; that the truck is either under or overloaded; that too much time is being used for loading and unloading; that too many stops are being made; that the truck is laid up too frequently, and that it is not routed so as to obtain the maximum speed.

The basic information for supplying all of this very valuable information can be easily obtained by the driver of the truck. Particularly is this so if a simple printed form is drawn up and supplied to him for this purpose, so that all he has to do is to insert a figure now and then. This form should be designed so that one small sheet will cover a day's operation of a truck. It should be ruled to include the leaving and returning time of each trip, the number of stops, either for delivery or pickup, time consumed in stopping, the out and in load in terms of load units (tons, gallons, barrels, sacks, packages, board feet, yards, etc.), as well as total daily truck mileage, the amount of gasoline and oil used, and the total time the truck was in service. It is also valuable to know weather and road conditions, particulars of delays, whether a helper or trailer is used, etc.

It can readily be seen that with a properly ruled and headed form it will be very easy for the driver to furnish the information wanted. With the above information in

hand, a very good idea can be had of truck performance, as well as complete information of actual operating costs.

From this information there can be determined the number of miles per gallon of gasoline and per quart of oil the truck is making, the number of hours it is actually in operation, the loads it carries, and the distance it travels. All of this will indicate whether or not the truck is operating efficiently, and the cost of its operation.

In order to have a complete record, the drivers' reports should be posted daily on forms provided for that purpose, so that a day-to-day comparison can be made of the performance of a given truck, as well as comparison of one truck with another, either in the same fleet or operated by someone else. The posted forms also permit of obtaining actual operating expenses for a month or a year, as well as for a day.

As has been said before, such records are now being uniformly kept on the costs of operation and the performance of perhaps 50,000 trucks, engaged in every line of business, and in all sections of the country. So that if the truck operator will but keep accurate and complete records on his own truck, he can compare them with those kept by some other operator in his line and his locality, and by this means know to some extent whether or not his hauling is costing him too much; and if so, in what particular items; and also whether or not he is obtaining as much work out of his truck as some other operator is getting.

Emphasis should be laid on the necessity of keeping accurate and complete records. It can easily be understood that inaccurate records are worthless, but it is not so easily understood that complete records must be kept to get the full picture.

Not only should all the items already enumerated be noted, but also drivers' wages, repair and overhead costs, gasoline and lubricant costs, tire mileage, and repairs and replacements, as well as the first or investment costs, from

which interest and sinking fund is computed. Both of these last items should be noted in their proper places. In fact, all of the items noted in the previous chapter as involved in estimating truck operating costs, should be considered.

If, because of repairs, it is necessary to hire a truck for the time being to replace the regular truck, the cost of such extra truck should be carefully noted, and charged against the regular one. Garage costs should also be considered, even though the truck is kept on the premises. The space occupied should be charged against it: and a proper share of the overhead pertaining to truck operation should be noted and charged in, such for instance as the garage superintendent, truck mechanics, washers, etc.

It is because of incomplete records that a truck operator will often say that he can "operate his truck for $7.00 per day, because he has kept a record and knows." He may have kept a record, but it was an incomplete one. Yet he believes he can operate his truck for this figure, and so do others, because he and they believe that the figures show it. The trouble is that he has left out a few important items. It is for this reason that we hear of extremely low ton-mile costs and other low unit costs. Until it is realized that proper costs and performances must be based on full and complete records, we will continue to have some phenomenally low costs reported which will be believed possible by a large number of people, both users and sellers, especially because they would like to believe such low costs possible. The actual cost of operating motor trucks in their proper field is so low, and there are so many other advantageous features in connection with such operation, that their use should not be retarded by inaccurate statements as to their cost of operation.

Is it not worth a few minutes a day to know that you are getting full mileage out of the tires; that the truck is operating and not standing still most of the time; that it is not

laid up too frequently for repairs; that gasoline and oil are not being wasted; that the truck is not oversped; that it is being operated to capacity; and that you have a careful, reliable and efficient driver? The keeping of truck performance records will do this and more.

Such records may tell you, for instance, that you have too large a truck, or too small, that the body is not adapted to the commodity you are handling, or that you have too many or too few trucks to do your work. It may also tell you that it will be cheaper for you to give up hired trucks and to place more of your own in operation, or that your business can be increased because of the extra distance your truck can operate after performing the work heretofore allotted to it.

One of the best uses to which cost and performance records can be put, is to furnish a basis on which to promote bonus systems and to determine awards for efficient operation. In this way, gasoline consumption can be cut down, tire mileage increased, and major repairs all but eliminated.

It has perhaps been general opinion that a one-truck fleet is too small to keep costs and performances on. This is a very much mistaken idea. The man operating but one truck is the one who can least afford not to have it operating most efficiently; and more often than not the one truck is but the beginning of a fleet, and the kind, size, and equipment of subsequent trucks, can best be determined by analyzing the performances of the first one.

The truck operator who is not keeping accurate and complete records of truck cost and performance, is losing a big opportunity to make more money for himself. There are printed forms for this purpose readily available at a very cheap price, in fact at cost, and as it takes but a very few minutes a day to use them, there is no excuse for any truck operator's not doing it.

If every truck operator, or even the great majority of

them, will keep truck operating costs, a clearer and better understanding of truck performance will result. This of course will be to the advantage not only to users of motor truck transportation, but to all others having a hauling, delivery or transportation problem.

In these days of the co-operative spirit, information on hand is usually available, if not directly, through an indirect medium, so that all my profit. It is so with other costs and practices, and it will be so in motor truck transportation costs and performances. When knowledge is made general, one learns from the other, and everyone benefits,—the user, the truck manufacturer, and the public Economical and efficient transportation is fundamental for the public comfort and convenience and for cheapness of living.

CHAPTER V

A Case in Point

In the consideration of motor truck transportation, it is highly essential, as brought out in the preceding two chapters, that a correct understanding be obtained of all the items entering into the operation of motor trucks, and that truck operating costs be carefully recorded by those using this form of transportation. Because all the items entering into truck operating costs have not been generally understood, and because actual operating records have not been generally kept, a misunderstanding has grown up as to actual motor truck operating costs, which makes it possible for those promoting this kind of transportation to misrepresent such costs. When operating figures are presented to a prospective user of motor trucks, he should make sure that they are complete and authentic.

There is plenty of information of a mis-leading character going about in this respect, information which is not confined to trade publications, but is also being circulated in popular mediums which reach the general public. For instance, a manufacturer of motor trucks, long in the business, carried a page advertisement recently in one of the popular magazines, having a circulation of over 2,000,000 copies. This advertisement stated that this particular motor truck did the work of five to nine teams at a cost of $7.00 per day, and was written around the following letter, which also appeared in the advertisement:

"NOTICE TO TAXPAYERS

"The undersigned makes this statement for the benefit of the taxpayers of ———— County. I have driven a ———— truck one hundred and three days in the county and worked in every township in the county but one, and in that time I hauled 1,030 yards of gravel an average distance of 5½ miles. I pulled a road drag 198 miles and the road grader 128 miles. I

have kept an account as correctly as possible, and in my judgment it will cost $7.00 per day to operate a truck, not counting anything for repairs, and in the 103 days we spent $.50 for fan belt, $2.00 for two spark plugs, total $2.50. A great many ask if I thought it paid. Well, a truck properly handled and put the push in it will do the work of from 5 to 9 teams, and to bear this statement out, will refer to the men I worked for, ———— (5 in all) ————. The subsuperintendents of the county think that my statement will enable the taxpayer to figure out for himself as to whether the truck pays. The county needs one truck in each commission district, is my judgment in the matter of trucks.

"Signature."

Although this letter is not specific as to the actual amount of work performed per day, it is quite impossible to operate that sized truck at a cost of $7.00 per day, taking all of the cost factors that must be considered, as brought out in Chapter II.

An effort was made to have this statement explained by addressing the truck manufacturer, and the employers of the writer of the letter referred to, for further information, as follows:

"*Gentlemen:*

"As one interested in motor vehicle transportation, your advertisement appearing in the current issue of ———— is very interesting, particularly Mr. ————'s letter, around which the advertisement is built.

"This letter states that in Mr. ————'s judgment, it costs $7.00 per day to operate a truck, based on his experience in operating one of your dump trucks 103 days. The letter appears to me to be ambiguous in some respects, and I would appreciate it if you will clear it up a little for me.

"Over what period of time were the 103 days included?

"What was the total mileage operated during these days?

"What was the average distance per day?

"What was the price of this truck, equipped with a cab and body, at the time of delivery, at the point delivered?

"What are Mr. ————'s wages?

"What was the cost of gasoline in ———— County during the time specified, and how many miles can be covered per gallon of gasoline with a ———— 5-ton dump truck?

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"In the letter Mr. ———— speaks of pulling a road drag 198 miles and the road grader 128 miles. Is this in addition to the work performed in hauling the gravel?

"Mr. ———— gives an average of 5½ miles. Is this an average of 5½ miles per yard, or what does it refer to?

"What is the character of the roads over which this truck operates?

"Your consideration to these questions will be greatly appreciated.

"Signature."

The truck manufacturer disregarded this request, and the following letter was received from the operator of the truck. This letter was written in long hand, exactly as printed below:

"Your communication was handed to me by Mr. ———— our County Road Supt. to explain, as i was the one that done the work and drove the truck.

"As to the expense, I used from 14 to 18 gallons of gass witched cost 20 cts per gal for the first 2 month, 22 cts the last month or over. They paid me 35 cts per hour.

"As to time consumed, from June 3 to Nov. 17.

"Cost of truck $4000.00.

"It would be a hard matter to get the total milag per day as i have some of my record misplaced not thinking i would ever use them again.

"In regard to me hulling the gravel will say i holled for 2 weeks or more 10½ miles made 4 trips per day. My holling was from 2 to 10½ miles. I was repairing roads all over the country. The road i holled over were hilley but solled when it rained and road became soft it would drag and grade.

"i am sub-superintendent. i have 70 miles of roads to maintain and keep up.

"I see you refer to a 5 ton truck. This was 3½ ton truck I would holl 3 to 3½ yds gravel.

"Just as i stated in me statement that was printed in ————

"I holled 1030 yds gravel a distance of 5½ miles pulled a drag 198 miles, puled a grade 128 mile. All of this work was done in 103 days and i referred me tax payers to the sub-superintendent that i done this work for men among the best we have in the county. Would be glad to give you any more information that you desire. I am not interested in any truck or company.

"i have worked at the road business for 35 years and interested in good roads, and i have got 70 miles of the best roads in ———— County, and

will say in conclusion that i don't think that any road man would make a mistake in buying a ———— truck.

"Hope to hear from you. Will say that it make a great difference in level roads and hilley road long and short trips in regard to the amount of gass used.

"Respectfully yours

"Signature."

From all of this it is perfectly evident that the operator of this truck did not understand truck operating costs and the motor truck manufacturer was trying to capitalize on incomplete and inaccurate information by spreading claims broadcast that the vehicles manufactured by him could be operated at a ridiculosuly low price per day.

This sort of propaganda is unnecessary, because the motor truck in its proper field is the most economical means of transportation.

CHAPTER VI

Motor Trucks *vs.* Horse Trucks

The 900,000 motor trucks in operation in the country today owe their existence primarily to the fact that they can perform a better service more economically than can horse-drawn trucks. Up to date, the work that the motor truck is mostly doing is that previously done by horses. It is true of course that motor trucks are doing some work formerly done by the railroads, but not yet to an extent to be comparable with that formerly done by horses. The motor truck has been promoted principally on the basis that it is a better unit for highway transportation than is the horse.

And yet, despite the tremendous amount of motor truck promotion, there are still a great many horses to be seen hauling freight. It might be expected that this would be the case in country districts where road conditions do not yet permit of heavy road units, but it is also noticeable in the larger cities where existing pavements are strong enough to sustain heavy motor trucks. This is substantiated by actual figures.

In 1919 there were 7,920 stables housing 75,740 horses in New York City, and in the same year there were 32,489 horse-drawn vehicles in the city of Chicago. It is quite true these figures show a material reduction from previous years, at a rate which implies that there will be few horses in these two cities in another five or six years. Still, the number is quite large, everything considered,—so large that the predictions made several years ago when motor trucks first began to appear on the streets, that horses would soon be a thing of the past, has not altogether been justified.

One of the main reasons for this is that some of those still operating horses do not appreciate the actual cost of horse operations as compared with motor truck operations, considering the amount of work that each can do.

With horses, as with motor trucks, it is the same old story of not knowing the real cost,—or not recognizing and taking into account all of the items entering into the cost of operating horse-drawn vehicles. When all of the items are considered and properly accounted for, the cost of operating a team of horses is considerably more than most people imagine. The following items should be taken into consideration when computing the actual cost of horse operation, and in considering them the cost of both truck and harness, as well as that of horses, should be included in arriving at the interest, insurance, depreciation, and repairs costs:

Interest on investment	Provender
Insurance	Stabling
License	Shoeing
Depreciation	Driver's wages
Repairs to equipment	Veterinary
	Supervision, office, telephone, advertising, etc.

With horse transport, as with motor trucks, it is impossible to give the cost of operating a two-horse team of horses per day that will hold good for all time, in any and in every community, and under every operating condition. Yet, on the statements of large and long established operators of horses with enough business ability and interest in their work to keep accurate and complete costs, the daily cost will run from ten to thirteen dollars and even over.

Now, the daily expense of a team of horses goes on practically irrespective of the work done, whereas the fewer miles a motor truck operates a day, the lower is its cost of operation. Perhaps the true way of comparing the operating costs by the two methods of transportation would be to compare the maximum work that a team can ac-

complish in a day with the cost of a motor truck doing the same amount of work.

A team of horses is limited both as to distance and as to load. The limiting distance is determined by the speed and the actual amount of work the horses can do without physical injury to themselves, and so as to be in condition to repeat the next day. The maximum average speed of a team of draft horses in front of a load is not more than three miles an hour, and ten hours would certainly be the limit of time; but it would be impossible for a team of horses to walk continuously and maintain their condition, so that instead of a day's work of 30 miles being possible, experience has shown that 15 miles per day is nearer right. Experience has also shown that three tons is about the maximum load average; so that it will cost at least ten dollars to move three tons fifteen miles by using a team of horses. But as the team must ordinarily return to its stable at night, the daily limit of operation is restricted to a radius of from 7 to 8 miles from the stable or base of operations.

On the other hand, taking every item into consideration in motor truck operating costs, as brought out in Chapter II, it will not cost on the average more than nine dollars a day to operate a three-ton motor truck fifteen miles per day. Thus, at conditions most favorable to the horse, it costs more to operate a team of horses a day than it does a motor truck of equal capacity, performing an equal amount of work.

Other considerations that should be noted are the investments in the two kinds of equipment, and also their respective lives.

A two-horse team with a three-ton wagon, together with harness, etc., will cost today approximately $1400 at the least, whereas a good three-ton motor truck, complete with body, will cost about $4200. This kind of truck on a fifteen mile a day basis should last twenty years, whereas

the average life of a team of horses hauling three tons fifteen miles per day would not be more than eight years.

Why is it then that there are still thousands of teams transporting commodities through the streets of our cities, where road conditions do not enter into the problem, when motor trucks can do the work at less cost, where they are more dependable in all seasons of the year, and when they have reserve daily work capacity several times that of the team?

Apparently there are just three reasons: one, *ignorance* as to the true operating costs of the two means of transportation, and as to the possibilities of the motor truck as against the team. Second, *lack of capital* necessary to make the greater investment. Third, those already having horse drawn equipment and engaged in purely *short haul work in congested districts*, find the horse in many instances equal to the truck. But it should be noted that these concerns usually have motor trucks as well as horses to supplement their work, and that as the horses wear out, they are usually replaced with motor trucks.

It has been stated by some that the horse is more economical in so-called short-haul work than is the motor truck; that where the stops are long and the mileage low, the motor truck cannot be used with economical financial advantage. This does not seem to be borne out when the actual costs are considered. By stops is meant those stops incidental to street congestion or congestion at the points of loading and unloading, so that the truck is delayed in reaching and getting away from these points. Because of their adaptability to loading and unloading devices, motor trucks can be used to better advantage in cutting down such time than can horse drawn vehicles. And certainly motor trucks, because of their shorter length and speedier pick up, are more flexible in congestion than teams. In fact, this is so true, that in order to obtain greater street capacity the time is undoubtedly coming

when horse-drawn vehicles will be ruled off of the most congested streets of the cities; particularly, slow-moving teams.

As has been said, the daily cost of a team, irrespective of daily mileage, is practically constant, whereas the daily cost of a motor truck is absolutely dependent on daily mileage. If, for instance, the team travels but five miles per day, its cost is the same as though it traveled fifteen miles per day, whereas, if a motor truck travels but five miles per day, its daily cost is less than if it travels fifteen miles per day, as was pointed out in Chapter II. No matter whether the team is moving or not, it must be fed and otherwise taken care of, whereas when a truck is not operating, all variable charges cease, with the possible exception of the driver's wages.

Again, it costs very little more to operate a six-ton motor truck than a three-ton motor truck, whereas in order to move six tons all at once with horses, it becomes necessary to employ two teams, thereby nearly doubling the expense.

And so it seems, that from every angle, with the exception of initial investment, it is actually more economical to use motor trucks even in short haul work than to use horses. The additional investment can be justified on the ground of longer life, more constant and dependable service, and the reserve always available for additional work when opportunity offers.

In transportation, speed times load equals work, and a motor truck is capable both of making greater speed and of carrying greater loads than horse drawn vehicles, so that it can render better service where such conditions prevail as will permit it to take advantage of these superior points. It can move quite as fast as the horse in congested districts, and at the same time can carry a greater load. Reaching its destination sooner, it can load and unload more quickly because it lends itself better to mechanical loading and unloading devices. Thus, in contracting work for instance,

even in congested districts the motor truck can carry more, and its available power can be so connected with the body as to be able to dump the load in a minute or two. So also with the delivery of coal. The limit of speed even with a big six-ton truck, controlled by a "governor" is four times that of a team of horses, and it can carry two times the load; and can on demand make 100 miles a day or more. The motor truck can, if necessary, work 24 hours a day, and summer heat and winter cold do not affect it. It is in just as good condition, and as ready to go on, at the end of ten hours' work as in the first hour. Not so with the horse.

The motor trucks of the New York Post Office work 18 hours per day in the most exacting kind of service. Schedules have to be met with better than train efficiency, heavy loads have to be carried, and high speed made through the city's streets in all seasons of the year, and every day in the year. Two drivers are used. The motor truck can endure more than man or beast.

In hauls of over 15 miles the motor truck costs much less than horses. Given a haul of 60 miles, the motor truck could make it in a day, whereas it would take a team 3 days and they would probably have to rest the fourth day. It would therefore cost three times as much with horses, because (remember) the fixed charges are the biggest part of truck operation, and are the same per day for a 60-mile day as for a 15-mile day. The truck in this run could also carry more than the team could haul, and would carry it about four times as fast. Then too, if necessary, the truck could, without damage to itself, be left in the street at the end of the run, whereas some place would have to be found to stable horses at night.

As a matter of fact, in hauls of over 15 miles, there can be no comparison, because that mileage is the daily limit of the team. Above this range, the motor truck enters the field which up to a short time ago was occupied exclusively

by the railroad. Here the question of comparatively fast transportation requires consideration, and this field of the motor truck will be discussed in the next Chapter.

The question of the motor truck as against the horse in rural districts presents a rather different aspect, and has assumed such large proportions recently that it will be taken up in a subsequent Chapter devoted to the Motor Truck and the Farmer.

In comparing the costs of operating motor trucks and horse drawn trucks, the mistake should not be made of comparing the cost of operation of one means of transportation in one community, with the other means of transportation in another community, because driver's wages, fuel, provender, operating conditions, etc., may not be on the same or comparable planes. Cost comparisons should only be made under like conditions. It is for this reason, as before stated (but it needs to be emphasized), that universal highway transport costs cannot be established. All of the cost items must be recognized, local wages and charges applied, and local and individual operating conditions considered in each case.

CHAPTER VII

The Motor Truck and the Railroad

A great deal has been said about motor trucks replacing horses in the moving of commodities, but until recently very little has been said about their supplementing the haulage work done by rail; yet a great part of the future of the motor truck undoubtedly lies in just this sort of work. The Great War demonstrated the possibilities of the truck along these lines, which possibilities are undergoing further development at the present time.

During the war, railroads were taxed to the limit, and the main lines and great terminals became congested to such an extent that the United States Railroad Administration gave notice that in certain communities commodities would have to be moved by truck so as to relieve rail congestion as much as possible. In order to move some commodities at all, it was necessary to use trucks because the railroads would not accept them on account of priorities. Again, because of the rail congestion, shippers, even though their commodities had priority, resorted to trucks because of the saving in time they could effect by their use.

All of this drew attention to the adaptability of the motor truck for what were then considered to be long hauls in this method of transportation; and since that time considerable study has been given to this phase of truck transportation. Many long-haul operations have been attempted, with some successes and with many failures.

The failures have resulted mostly because those interested have failed to recognize and take into account certain necessary fundamentals which must exist to make this kind of truck operation successful, and which have always existed where success has been attained. It has been primarily because favorable conditions have been

present, without any real investigation showing this to be so or without any real understanding that they did exist, that many successes have occurred. Poor business management has also resulted in numerous failures. Many people have gone into long distance truck hauling who have had no business ability, and who have imagined that all there was to it was to purchase a truck and start operating it between two or more points, and their fortunes would soon be made.

The truck manufacturers as a whole, and the tire companies as well, have also been responsible for many of the long distance truck failures. In order to dispose of their products and to widen the market for them, they have urged that trucking lines be established, irrespective of the merits of the particular proposition; and that shippers generally either patronize such lines or purchase and operate their own trucks. The manufacturers as a whole have even gone so far as to sell trucks on easy terms to those desiring to go into this business. All of this, however, has had its good effect as well as its bad effect. It has discovered, to some extent at least, what conditions must prevail if the truck is to enter this field successfully, and also to some extent how the truck must be operated if it is to succeed in this kind of work. It is also demonstrating the limits of the truck, insofar as economical length of haul is concerned.

These demonstrations, however, have not as yet finally settled anything along this line. Experiments are still going on, that are accomplishing a vast amount of good, not only in this direction but in another direction as well, that is, in pointing out the real and complete costs of rail transportation; which have been shown to include something more than simply the freight rates quoted between the places from and to which the freight movement takes place. These demonstrations have also about proved that the motor truck cannot take the place of the railroad in

so-called long distance hauls as a general and usual thing; although in some unusual cases it may prove to be more economical for particular reasons to resort to the motor truck rather than to use rail operation in quite a long haul. The manufacturers have demonstrated to those interested in the motor truck industry that they are really producing a means of transportation and not merely a mechanical device. In order to dispose of their products advantageously, not only from the standpoint of the present but from that of the future as well, they must approach their marketing problems from a transportation standpoint; which of course, will be beneficial to all concerned.

In approaching this problem, here again a complete knowledge of all of the items entering into the cost of motor truck operation must be obtained. If they are not known and applied, how is it possible to determine a rate that will be profitable, or that will show the futility of competing with existing means of transportation between the points in question? Or if the shipper intends to operate his own trucks in this kind of service, how will he know which is the least expensive means of transport unless he knows all of the items that enter into truck and rail delivery under his conditions, and applies them? The mere fact that some other operator is in successful operation over a route of equal or nearly equal distance, or that some other shipper is operating his own trucks between the same two places in question, is no criterion that it can be done equally as well in the case under consideration. The operations in existence and seemingly successful may be a guide to anyone contemplating similiar operations, and that is about all. Each individual case must be decided on its own merits. Let this fact once sink in and the motor truck will soon find its place in distance hauling, for there is no doubt but that it has its place there.

In the chapter on Truck Operating Cost Factors, the items necessary to ascertain true costs were discussed.

It was stated there that the item of overhead costs was a very important one, and that it was often overlooked. The overhead cost in conducting highway transportation lines is usually very large in itself, and in proportion to other operating items; yet it is seldom provided for in estimating the probable cost of conducting such lines or in considering the cost after operations have started. Yet how is a line of this kind to be successfully operated if it is not properly supervised, business solicited, freight stations maintained, and an office equipped so that business can be properly conducted? All of this costs money.

In determining whether the motor truck or the railroad is the more economical to use, many factors should be taken into consideration, to some of which as yet very little attention has been given. We have already discussed all of the factors entering into motor truck costs. Now let us take up those included in transportation by rail.

It is a peculiar fact that most shippers seem to think that the entire cost of rail transportation is in the rail rate paid to the railroad company itself. As a matter of fact, this is only one item. They forget that the railroads require most L.C.L. (less than carload) freight to be crated or boxed, and that this costs real money, not only for the material going into the crates, but in the labor to put the material together and in the space taken up to have the material stored and this work done; and all three of these items of cost are today very high. The shipper also forgets that boxing or crating adds very materially to the weight of the article being shipped, and as the rail freight is based on total weight of article and packing, he pays the railroad not only to transport his commodity, but its container also. Many shippers would probably be surprised to learn on investigation that the containers sometimes cost more than the freight rate on the article they contain, and that they weigh more than the article itself.

Shippers also seem to forget that it costs money to have

their freight picked up from their own loading platforms and delivered to the rail freight stations and picked up from the rail freight stations at the other end of the line and delivered to the consignee. The railroad does not perform this service free, and if it is performed by an outside trucking concern, it is charged for by weight; and here again the weight of the container comes in.

The reason the railroads require crating or boxing is so that the article itself will be protected from damage, likely to result from the many handlings necessary if this form of transportation is resorted to. And even so, goods shipped by rail are frequently damaged, and when this occurs it usually takes a long time to settle the claim; and of course there are the indirect losses which must be suffered because of the delay necessitated for replacing the damaged article.

To get the actual cost of L.C.L. shipments by rail, it is necessary to add to the freight rate, cost of boxing or crating, including the material, labor and space necessary to do the work, the cost of carting the crated goods from the shipper's platform to the railroad station, and from the railroad station to the consignee's platform, as well as the excess freight due to the container itself.

Of course, when shipment by express is considered the delivering of the goods to and from the railroad station is eliminated, express shipments being door-to-door propositions.

The average of the first, second, and third-class railroad rates from New York to Philadelphia is 39c per hundred pounds, to which should be added 30c per hundred pounds for delivering and collecting at the two ends of the line, or a total of 69c. Shipments can be made directly from door to door by motor truck for as low as 85c per hundred pounds, 5-ton lots, by reliable motor trucking lines, or for 16c more than by railroad freight. This is only 9c more than the first-class rate. When it is considered that it is

usually unnecessary to pack goods going by motor truck, the 16c is more than offset by the elimination of packing costs and the weight of the container.

In hundred-pound lots the trucking rate is $1.00, and it is believed that the difference between this rate and the railroad freight rate would be more than offset when these costs are taken into consideration.

On the other hand, the first-class express rate from New York to Philadelphia is $1.45 per hundred pounds. This is a door-to-door delivery, but crating or boxing is usually required.

In addition to this saving by motor truck in the direct costs, there is an indirect saving. Because of the two handlings only,—on to the truck and off of the same truck at the other end—goods are very seldom damaged, and if they are damaged, claims can be usually adjusted immediately. Goods are seldom damaged by motor truck, not only because of the reduction in handling as compared with railroad transportation, but also because the loading is usually done under the supervision of the consignor, and unloading under the supervision of the consignee; whereas if goods are shipped by railroad freight or express, most of the handling takes place under the supervision of no one particularly interested.

It is quite impossible to quote standard crating and boxing costs, or to estimate how much crating and boxing adds to the weight, such costs varying according to the nature, size and weight of the commodity. As an indication, however, of what can be expected along this line, the traffic manager of one of the large industries has made investigations in this connection, and states that in his particular business the weight of the container adds 17 per cent. to the railroad transportation cost, and the cost of the container adds 24c to the cost of transport per hundred pounds of commodity; and it should be noted that the commodity with which this concern deals is rather heavy.

If the shipper does his own trucking with his own motor trucks, it will cost him considerably less than the railroad rates (plus the other expenses referred to) on short hauls. For instance, if a motor trucking line can make a rate of 85c to $1.00 per hundred pounds from New York to Philadelphia, a distance of ninety miles, and make money by so doing, the shipper by using his own trucks (when he would not be expected to make money on the haul), could perform this transportation for very much less money. This was found to be the case by the traffic manager referred to above.

In addition to the enumerated direct savings in cost by using the motor truck, the question of time is an important one to be considered, because for short distances the motor truck is faster than railroad freight or railroad express; and with the development of good roads and pneumatic tires, the speed of the motor truck is likely to be increased.

A type of heavy duty truck used in inter-city hauling.

For instance, motor trucks operate between New York and Philadelphia overnight, whereas the best that express can do, under normal conditions, is two days, and railroad freight takes a week more often than not. It should be considered that when freight is received at a railroad freight the consignee is first notified and that then he must make arrangements to pick the freight up, all of which takes time.

It has been said that the economical range of the motor truck has not yet been determined, but no less an authority than an official of one of our greatest railroads has recently stated that for hauls up to forty miles it was economical to use the motor truck. Road conditions, quantity of freight, and possibility of return loads are some of the important elements that determine this economical length of haul.

Another important item to be considered in connection with the time element is that by using motor trucks it is unnecessary to carry such a large inventory of goods, if supplies can be obtained from sources within motor trucking distances. In other words, speaking of this phase of the subject in terms of maximum possibilities, it would be necessary under motor truck conditions to carry but one day's supply of stock, whereas if railroad freight is depended on, it would be necessary to carry from a week's to a ten day's supply.

Another phase of this subject is, that motor trucks are more reliable than railroads, in that they are not subject to embargoes. With their use, the shipper is not likely to be entirely cut off as he is at times by the railroad. Motor trucks have proven, if given proper road conditions, that they can operate just as reliably as railroads, winter as well as summer, and now that the States and Counties are beginning to appropriate money and organize to clear the highways of snow and ice in the winter time, such operation will be even more reliable. There are instances where motor trucks have been kept going when the railroads have had to shut down because of weather conditions.

In order to determine, therefore, whether it is more economical to use motor trucks or to ship by rail, all of the foregoing considerations should be taken into account; and unless all of these items are taken into account, the shipper cannot determine which is the more economical.

If the shipper finally decides that it is more economical to ship by motor truck, he cannot determine whether or not he should use public motor trucking lines, or operate his own trucks, unless he knows the quantity of freight he has to ship to the various points, and whether or not he has goods or material coming back to him from the points to which he ships, or whether or not he could make arrangements to carry goods back to some other concern located in his own vicinity. A survey might show that rather than patronize a motor trucking line, it would be advisable for two or three or even more shippers to combine and operate their own trucks, if the one shipper did not have enough business to justify his operating his own truck or fleet of trucks.

If the shipper finally determines, after a proper survey has been made, that it is cheaper and more desirable from every standpoint, to use a public motor trucking line, he should be sure that the line he patronizes is operated along proper business lines, has sufficient capital to carry on its operations, has the proper kind of equipment, and that his goods will be fully protected by insurance.

It has been said that the economical range of the motor truck as compared with the railroad has not yet been determined and no less an authority than an official of one of our greatest railroads has recently stated that for hauls up to forty miles it was more economical to use the motor truck. Comparative costs of both means of transportation under like conditions would indicate what the economical range is. As a general thing, knowing what we do about the costs of the two methods, this distance of forty miles seems to be somewhere near right, although local conditions will often decrease or increase it.

The reason why a motor truck can compete with the railroad between two points near together is that terminal costs are so great that the short-line haul does not give the railroad an opportunity to absorb them. The railroads do not, to any great extent, separate their terminal costs. Yet from figures submitted to the Inter-State Commerce Commission a few years ago, the Commission stated:

"The combined average terminal cost at one end is shown to be 10.4 cents per hundred pounds. For two terminal buildings (origin and destination) this figure doubled results in 20.8 cents per hundred pounds; and as this figure contains no element of overhead costs, or taxes, such costs are arrived at by dividing the terminal cost by the operating ratio.

"The operating ratio of the Trunk Line roads for 1915, 1916, and 1917 is 69.6, and the result of dividing the terminal cost of 20.8 cents by the operating ratio is *30 cents* per hundred pounds, which covers terminal expenses and overhead for less than carload freight."

Now taking this figure of 30 cents a hundred, or $6.00 a ton, and disregarding the fact that all costs have increased since these figures were compiled, there would be $30.00 available to operate a five-ton motor truck without adding the additional cost of railroad line haul. A five-ton motor truck can operate forty miles a day for $30.00 a day, taking into account every item of expense, covered in the chapters on cost, and with average roads, average congestion and average loading and unloading conditions. It would seem therefore that the railroad official may have been even a little conservative in his estimate of an average of forty miles. Hard level roads, reasonably free from congestion, and capacity loads in each direction, will perhaps more than double this distance, especially when conditions are such that trailers can be used.

At any rate we can now see why the short-haul, less-than-car-load freight, is not profitable to the railroad. It

costs them more than they get for it. And with present methods it clutters up their terminals so that everything and everybody is delayed.

In connection with all of this it is especially interesting to note that the motor truck will not only aid the railroads in solving the short haul problem, but that it will also help them in clearing their terminals of all freight so that what they do handle will move more expeditiously.

An example of how the motor truck can be applied to terminal work to advantage has been afforded in connection with transferring freight to and from the various terminals in Cincinnati, Ohio.

Cincinnati terminal motor truck operation. Truck with loaded removable body leaving a railroad platform. 14 truck chasses operating continuously handle 225 bodies, replacing 115 slow-moving horse-drawn vehicles and 75 freight cars and avoiding waits while freight is being sorted into the bodies.

Fourteen motor truck chasses are now used where formerly it required 115 slow moving horse drawn vehicles and 75 freight cars to transfer freight from terminal to

terminal. This has been accomplished through the use of demountable bodies, 225 of which are being handled by the 14 chasses. The chasses are operated continuously. They do not wait while the freight is being sorted into the bodies.

With this system, street congestion has been lessened, cars released for main line work, transfers speedily made, damaged freight reduced, platform space cut down and yet the freight has been handled and transferred at a lower cost than before. To substantiate these claims, note the following from the annual report of Walter D. Hines, formerly director-general of railroads:

"The motor terminal system at Cincinnati, providing for the handling of freight between the various terminals by motor trucks with removable bodies, was inaugurated May 10th, 1919, and is working satisfactorily. Some of the advantages are quick despatch of freight; saving of two handlings; 50 per cent. decrease in damage to freight in loading and unloading, and a decrease of about 15 per cent. per ton in cost of handling."

This installation of motor trucks is a remarkable demonstration of the fact that they can be used to advantage in extremely short hauls under congested conditions.

In Cincinnati, the six railroads entering the district operate 12 main freight stations and 9 sub-stations. The minimum distance between the main stations is one-half mile. The maximum is 2¼ miles. The minimum distance between main stations and sub-stations of the various roads is 2½ miles and the maximum 9½ miles. The average distance of haul between the main stations is one mile; between the main stations and sub-stations is about 3½ miles.

If it were not for the removable body feature it can readily be seen that motor trucks could not very well fit into a congested short haul condition of this kind. They would be standing still about 90 per cent. of the time. We

Cincinnati terminal motor truck operation. Removable bodies permit the loading of these trucks with several tons of miscellaneous freight in a very few moments.

discuss in the Chapter on "Bodies" and in the Chapter in "Loading and Unloading Devices" how necessary it is to keep a motor truck moving to get the most efficient use out of it.

Store-door delivery (which would probably help in removing congestion at the railroad receiving and shipping stations to such an extent that railroad, shipper and receiver would greatly benefit) will no doubt come sooner than otherwise would be the case, because of the availability of the motor truck.

Much of the costly delay—costly to shipper, receiver and railroad alike— is caused by the piling up of freight on the platforms or by freight held in the cars awaiting the pleasure of the receiver. Under the present system, when freight is received the consignee is notified by mail by the railroad company. This takes time, and despite the penalties imposed the consignee does not always act promptly to come and pick it up. As a consequence there is usually a congestion of freight on the platforms or in the stations and this situation is made worse because of the delays caused the truckmen in the effort to locate their freight. Because of these long delays it has usually been found economical to use horse-drawn vehicles in this work.

Again, the consignment of freight may be only part of a horse drawn truck load. Remember a motor truck can only be employed to the best advantage when it can be kept moving with capacity loads. Consider again the truck transportation laws of cost as given in Chapter III and it will be apparent that motor truck ton-mile costs decrease as the truck capacity increases. Chapter II on Cost Factors tells why.

Now, store-door delivery and collection simply means that instead of the railroads piling the freight up at the stations and expecting the receivers to pick it up, the railroad itself will deliver the freight from the stations to the door of the receiver and pick it up from the door of the

shipper, all as part of its service. This service would be performed either by railroad-owned trucks or by well organized and well managed trucking organizations, directed to a large extent by the railroads.

With such a scheme in effect the community could be zoned, certain trucks assigned to each zone, and the freight destined for each zone would be immediately assigned to and loaded into the truck going into that zone. Thus, platform delays would be eliminated, truck capacity loads be made, and the motor truck be made use of; and hence station delivery costs would be reduced and street congestion would be lessened. The same trucks would collect in their respective zones and by the same token cut down incoming delays and costs.

The motor truck affords a means of making store-door delivery and collection efficient. All that is needed is an understanding that this is so and the obstacles that have obstructed this economic movement will disappear.

The necessities of the Great War increased still more the tremendous congestion already existing at the freight stations and terminals in many of the cities. It was the War that developed the opportunity for coordinating the railroads in Cincinnati to the extent of causing them to adopt the motor trucking system in use there for transferring freight between themselves. The system has already been described, and will be further referred to in the Chapter on Bodies. And the war came very near establishing store-door delivery in the greater part of New York, where freight station congestion is very great.

Judge Harlan, Interstate Commerce Commissioner, was requested by the Director General of Railroads to investigate conditions in New York and to suggest a remedy. After several months of close study, Judge Harlan reported:

"What is urgently needed is, that all inbound freight shall be taken away from piers and terminals as it is unloaded from the cars. Besides freeing the cars for out-

bound loads the station itself is freed and room made for other inbound freight."

The Judge closed his report by recommending a store-door delivery and pick-up service to be operated by the railroads as a railroad service under special trucking charges fixed in their tariffs. But the ending of the War also ended this proposal and permitted the obstacles to crop up again.

The theory of store-door delivery is so fundamentally sound, that it will not down. With the aid of the motor truck, with its speed, large capacity, economy of operation and adaptability to removable bodies, loading and unloading devices, its dependability, flexibility and ease of control through routing and dispatching methods, it is going to come soon and be efficient when it does come, just as it has proved to be in England and Canada and as it was for 45 years in our own city of Baltimore.

That it is not now in operation is just as much the fault of the shippers themselves and of the truckmen as it is of the railroads, and probably more so.

In fact, it would seem that most of the fault lies with the shippers and this comes very nearly meaning the general public. As an indication of the way the railroads are beginning to look at this situation, recent experiments on the part of one of our greatest railroads, The New York Central, are worthy of note. This railroad, in an attempt to relieve the congestion of traffic due to delays in loading and unloading the present type of freight car with less-than-carload shipments, has in conjunction with the American Express Company and the motor truck interests developed and operated what is known as a "container car." The experiment has been at least successful enough to warrant the construction of other cars of a similar nature.

With this system, the portable container is loaded and locked on the shippers' premises and then conveyed by motor trucks to the car and lifted aboard. At destination,

The new "container" car of the New York Central consisting of nine containers of 6,000 lbs. capacity each is loaded and unloaded in 40 minutes. This operation depends on motor trucks which bring the loaded containers from the shipper to the car and from the car to the shipper. Many handlings and billings are saved. The goods are safe from theft and damage and car loading time is materially decreased.

the container is lifted from the car to motor truck and thence carried by it direct to consignee. Thus, greater security for shipment in transit is assured, both from pilferage and from damage; intermediate handlings and checkings are done away with, boxing and crating is unnecessary, and the actual use of cars in actual service increased. With this system, the cars can be very quickly unloaded by simply removing the containers and quickly loaded again by placing other containers on board. It has been stated that the first car built for this service

Loading removable container from New York Central "container" car to motor truck. This method of transportation permits shippers to transport their goods without loss and without damage, the containers being loaded and locked on shippers' premises.

loaded and unloaded its nine containers each 9 ft. long by 6 ft. wide by 7 ft. 4 in. long, and having a capacity of 6,000 lbs., in 40 minutes. The most expert crew of freight handlers, equipped with platform trucks, could not come anywhere near equalling this performance. And the crudest kind of an arrangement was employed for lifting the containers.

We can see in this laudable effort a combination of the Cincinnati Terminal motor truck and removable body operation and the store-door delivery plan, yet in the combination each idea is carried further. It is to be noted that the "car container" idea embodies the same principle as the removable truck body idea, and aims to so handle the load that the carrier (whether truck or car) is kept moving the greater part of the time with capacity loads. The savings in such an operation are tremendous from every standpoint and are possible only with the motor truck, coordinated with the railroad.

Of course terminal machinery is necessary at the terminals as well as at the shippers' platforms to permit of the handling of the containers. The Cincinnati operation has conclusively proven that such machinery is practicable, is so far as the terminals are concerned. Here, hoisting machinery has been installed in almost every conceivable kind of a station; and as practically all of them had been in existence for a number of years and so was not at all originally adapted for this work. Mr. B. F. Fitch, head of the Cincinnati Motor Terminals Company, certainly deserves a great deal of credit for his work there. On the other hand, there are several successful installations for removing motor truck bodies on the premises of shippers. As yet, these are not used in connection with railroad work, but simply to interchange loaded bodies for empty bodies or for other incoming loaded bodies, so as to keep the truck rolling.

By this time it should be evident how important the

subjects of motor truck bodies and loading and unloading devices are. The subsequent chapters in these subjects should be carefully read in considering efficient motor truck transportation.

Another application of the motor truck to assist the railroads in particularly light traffic territory is the addition of flanged wheels to the motor truck wheels so that the truck can run right onto the track from the highway and thence proceed under its own power on the rails, and then run off the rails onto the highway at destination. In this operation no transfer of freight or of body is necessary. Experiments have proved the feasibility of such an operation, in connection with which no loading machinery is necessary to transfer the truck load to rail haul.

The railroads are at least alive to the possibilities of store-door delivery. In fact, they may be said to be, in at least some instances, working ahead of the rest of us: and they may go as far as they can alone. As has been said, the truckman and the shipper must coördinate to put this universally promising remedial measure into effect.

The truckmen, at least the progressive thinking ones, are apparently doing some very hard and favorable thinking, relative to store-door delivery. No less a trucking authority than Mr. Arthur G. McKeever, one of New York City's most representative truckmen and Vice-President of the Merchant Truckmen's Bureau of New York, the members of which own and operate 7,000 horses and 2,500 Motor Trucks, in the March 1921 issue of "Commercial Transportation News" (published by the Bureau), under a section headed Store-Door Delivery, in an article entitled: "Trucking Industry Carefully Analyzed," writes:

"While trucking companies have attained more or less efficiency in spite of the existing method of distributing freight from the piers, the method itself is as primitive as when the clipper ship tied to the wharf, and the captain notified the owners of the cargo to send for it.

"Parcels post and express companies carry from the consignor to the consignee's address. Freight arrives at the carrier terminal and there the movement of it by the carrier stops, and must be completed by the owner of the merchandise.

"This interruption, as against a continued movement of the freight, means for the carrier higher terminal charges because of added risk of pilferage and breakage, more labor for assorting, rehandling, checking and clerical work, more space in which to handle, and the expense of sending out notices of arrival. Furthermore, the inability of the carrier to move the freight immediately upon arrival often results in congestion which backs up freight on the road. In trucking, we find delays at piers in locating freight and arranging for its delivery, that routes are duplicated and that trucks move partly loaded. All of these facts will continue to exert an economic pressure to bring about the movement of freight from the point of origin to final destination by one agency or by an organization working under or in conjunction with the carrier. The 'store-door delivery' which provides for this has been widely discussed and plans are now actively in progress for its development."

It is estimated that a freight car spends 9 per cent. of its time in the repair-shops, 37 per cent. in the hands of the shipper or receiver, 43 per cent. between points of loading and terminals and only 11 per cent. from terminal to terminal, or actually hauling on the main line.

These figures again show why the railroad short haul is so unprofitable, and the extreme necessity of cutting down the time of loading and unloading freight cars. The motor truck can assist the railroads in both of these respects, and in behalf of the distributor and the consumer it should be coördinated with the railroad to this extent at least. Let us forget, for the time being anyway, that it has any economic place in the railroad long haul, except in unusual cases.

THE MOTOR TRUCK AND THE RAILROAD

The motor truck will have made a real achievement, if it assists in solving the branch line, the stub end, the railroad short haul and the terminal problems. (For a further discussion of how the motor truck can assist in the branch line, stub-end, and light traffic territory fields, see Chapter 1 on the *Future of the Motor Truck* and Chapter XIV on the *Motor Truck and the Farmer*.) After a further development of real highways, pneumatic tires and truck chasses adapted to them, and of trailers, we can begin to think of the field of the motor truck in railroad long hauls.

CHAPTER VIII

The Value of Highway Transport Surveys

What follows is an address made by the author at the annual convention of the National Highway Traffic Association and the highway transport conference of the National Automobile Chamber of Commerce, held on January 29, 1920, in Chicago:

To give a concrete picture of the intrinsic wealth of the world, statisticians sometimes resort to the device of tabulating the debts that are carried by the various nations. The world war, by demonstrating the staggering total of debt which the fighting nations could shoulder and still remain economically sound, was a revelation of uncounted resources in world wealth both to the laity and to many business men who had considered themselves well informed.

In the field of highway transport, there has been a colossal number of failures, and reports of new transportation companies that have failed are received almost daily. If these debts, the money losses represented by these failures—failures due in a large part to the absence of transport surveys—were the sole reason for the development of such surveys, their value would run into millions.

Insurance against failure is, however, but a small part of the real value of highway transport surveys. Many companies in existence today would, if such investigations were generally resorted to, be able to render greater service to the public and make increasing profits for themselves, and these surveys would undoubtedly establish the desirability of highway transportation lines where as yet such lines have not even been thought of.

The prevalence of failures, paralleling the failures in the automotive industry in its early days, and the number of lines that are operating with a minimum of benefit to

themselves and to their public, indicates only the most cursory analysis of the territory to be served, or no analysis at all. Many firms are floundering without chart or compass and we should all do all in our power to correct the prevalent opinion that all that is necessary is to buy a motor truck of any make you please and any capacity offered, to start it operating over any road available, during any time of the day or week when the driver feels like it, and to charge any price for his services that may come into his head just so long as it is lower than any other price charged for transportation between the points in question.

Just as long as the public has this picture of motor transport lines, just so long will the motor truck incompletely realize its effectiveness. That it can be effective has been proven beyond a doubt. As a mechanical device it has demonstrated its dependability and durability and we have enough experience to know that economically it can perform, and must be made to perform more and more, its function as part of the transportation system of this country.

We are considering the value of highway transport surveys at a time when many business problems of vital importance are pressing for solution. Living costs are high. Labor is scarce. The railroad car shortage is acute, and the thousand problems of production are crowding in upon us daily. In all of these problems of our complex business life, there is no factor that affects every phase of economic activity more fundamentally than does transportation. It is, we might say, the very life blood of business; and everything that we can do to increase transportation facilities, decrease transportation costs, and shorten the time in transit, is a vital benefit. Highway transport surveys are, then, not only desirable, but at the present juncture of business conditions, fundamentally necessary.

If we are to survey the field in the broadest and most

constructive manner, we must do so in conjunction with a survey of other and longer established means of transportation, especially the steam and electric railways. As an aid to these already existing systems, extending their usefulness in many territories, and even replacing them where such practice proves economically desirable, the motor truck has a tremendous field of usefulness. Just where this usefulness begins and ends, how to cover all territories thoroughly and yet avoid duplication of effort, can only be ascertained by complete and far-reaching surveys.

Traffic experts of the railroads themselves are giving deep thought to the availability of the motor truck in supplementing their present facilities. The present shortage of both track mileage and of freight cars makes the subject a most pressing one for the railroads and a most encouraging one for us who are interested more especially in the automotive branch of transportation.

According to figures from the Interstate Commerce Commission, the total single track mileage of the United States, January 1, 1918, was 253,626 miles; and statistics show that the railroad mileage in this country has recently decreased instead of increased. Last year 689 miles of line were abandoned. This exceeds by three miles the mileage of new lines built during the year. Furthermore, 1919 was the third year in succession in which reports have shown the mileage abandoned to have exceeded the mileage of new lines built. During the three years from 1917 to 1919 inclusive, operation was abandoned on 3,319 miles of line; and in the same period only 2,386 miles in extensions, branches, and new lines were completed and placed in service. Thus during this period, there has been an actual decrease of 933 miles in the mileage of railroads in the United States. It is interesting to note that this tendency to decrease railroad mileage is shown in all three railroad districts—eastern, southern, and western.

These figures are taken from *Railway Age*, an authority on steam railroad construction and operation. This authority is also responsible for the statement that the greatest freight car surplus ever recorded on the American railroads occurred in March, 1919, when there were 450,000 cars idle; that today there is a shortage of 570,000 cars, that the railroads are, at present, unable to handle all the traffic that is offered to them: and that while the present traffic is unusually heavy, further increase can be expected within the next few years. Records of past performances indicate that the future business cannot be handled without serious shortages of equipment unless a great many additional cars are acquired.

In addition to this tremendous freight car shortage there is also a great shortage in motive power. It is estimated that nearly 8,000 units of 60,000 pounds average tractive effort should be built during the next three years to take care of freight traffic alone.

Director General Walker D. Hines, of the United States Railroad Administration, is quoted in an address before the American Railway Guild on November 18th, as saying:

"As well as I can estimate the situation, I believe we are likely to have a large railroad traffic in this country for some time to come. During the war many of the normal demands of the public had to go unsatisfied; there was much building which had to be postponed and many sorts of activities had to remain in abeyance. The opportunity has now come to satisfy those demands, and the building that is beginning to develop and the other activities which are now getting back to a normal basis create a demand for a very large railroad traffic. So I think the railroads must be prepared to handle a large business for a considerable period."

Railway Age is also responsible for the statement that:

"Insufficient terminal facilities constitute a weak link

in the American transportation system. Under government control the consolidation of forces and facilities was greatly expanded.

"The outlook for a continuance of unification is not propitious, the consensus of opinion being that it is an excellent idea but impossible of realization following return of roads to private management.

"Solving of the problem of inadequate terminal facilities and of needed co-ordination of their operation, is imperative."

This great shortage of freight cars and motive power and the insufficiency of terminal facilities, in the face of increased traffic, indicates that the motor truck and the highway must be more extensively used than at present if the business of the nation is to be kept moving in the manner that it should. That it shall be kept moving is absolutely necessary to the life of business and its continued growth.

If we compare, for a moment, the total highway mileage in the country with the railroad mileage, which is as ten to one, and if we also consider the flexibility of the motor truck as against rail operation and that one method of transport is quite as dependable as the other, we can begin to realize the work that highway transport should be made to do.

In this connection it is also interesting to note that the freight car makes an average of but fifteen miles a day and that the average tons per loaded car is less than 28. From this we can get an even better picture of how the motor truck can greatly assist the railroads in moving the traffic of the country.

I do not believe that the motor truck should compete with the railroads, as a general proposition, but I do believe that they should be operated when it can be shown that it is more economical for such operation to take place.

By economical I mean where the motor truck, as compared with the railroads, can cut down the time of delivery, and make such delivery more frequently and at less cost.

When we realize the number of absolute business geniuses who have devoted their lives to railroad transportation problems, and then realize the extent to which highway transportation can be employed to supplement and extend the usefulness of these same lines, we have a prospect before us broad enough to satisfy the most ambitious and those with the highest ideals.

After studying the steam railroads, in considering the motor truck as an aid to existing means of transportation, a highway transport survey would concern itself with the relation of highway transport to electric railway service.

The electric railway situation in the cities and suburban and rural districts of this country is in a very chaotic condition. Many lines have been abandoned; others thrown into the hands of receivers, fares raised and service curtailed —all to the great disadvantage of the travelling public. I am quite sure that local surveys would frequently indicate that highway transport in the form of motor busses can very greatly relieve this situation.

In a recent issue of the "Electric Railway Journal" an authority on the electric railway industry, the assistant to the president of the railway company in one of our large cities, in discussing how busses are run in that city in connection with the railway, makes the following statement:

"It is believed the motor bus is here to stay, that its use is going to increase largely and that the logical people to handle and develop it are those who have been trained and received their experience in street railway operation. It behooves the progressive street railway manager to study the motor bus situation and be prepared to meet it and to use it as an auxiliary to his other operations, rather than have to fight it as a competitor."

The busses in the city of Newark, N. J., a city of 400,000 people, carried 16,000,000 passengers the first half of last year and statistics from several other cities indicate that the bus surely is here to stay.

Yet many operations of this kind have been inaugurated and have failed, or are not operating to the best advantage of the general public. The proper kind of survey will, in most instances, prevent such failures and cause the successful operators to give even better service and be more efficient and point the way to where new operations are desirable and how to successfully inaugurate them.

No general survey of the field of highway transport would be complete that left out of account its use in districts now without rail facilities. Mines, forests, and quarries situated in remote sections are generally exploited by big organizations with financial backing sufficient to solve their own transportation problems, and many of them are finding their solution in the use of the motor truck.

In the farming sections, however, where the productive unit is comparatively small, there has not been the same incentive for big business to make a thorough survey of conditions and here there is a tremendous field of opportunity.

The same factors that affect the big manufacturing institutions in the industrial centers—rising costs, labor shortage, and lack of adequate transportation facilities—affect equally the producers in the fields. The situation is serious and at any time may become acute. Every help that can be given to the producer of food-stuffs adds to the well-being of the nation.

Some one in authority has said that if the labor situation on the farms is not relieved in some manner, that in a short time, for a certain period, some of those in commercial and industrial life will have to assist the farmer in harvesting his crops if we are to obtain a sufficient amount of farm products. One answer to this, and probably the most

logical one, is so to arrange the farmer's transportation that it will be unnecessary for him to take labor from his farm to perform this function, as heretofore. A proper use of the motor truck and the highway will go a long way toward meeting this problem.

Our present system of food distribution is probably the most expensive the world has ever known. That the motor truck can reduce such costs has been proven absolutely

Pneumatic tired motor trucks operated by the Post-Office Department are helping the country folk to cheaper, more dependable and increased transportation and communication.

by the Government itself. The savings effected by Assistant Postmaster Blakeslee in his actual demonstration of highway transport lines from some of the rural districts in Pennsylvania to Philadelphia and Washington are significant, to say the least. On an exhibit recently shown the Committee on Post Roads and Postal Service of the House of Representatives, by Mr. Blakeslee, of 41 trips

made by the motor vehicle truck routes, a saving of $6,612 to the consumer was the result. Added to this was the time saved to the farmers who had their produce taken from their gates to the market and who were thus enabled to continue performing actual work on their farms. Just previous to the inauguration of these routes by the Post Office Department, I helped to make a survey of part of this district which indicated the savings later effected. Yet the people there did not realize how materially they could be assisted until this investigation had been made.

Speaking of railroads, I was reminded a minute ago of a story which no doubt many of you have heard, of the sturdy freight engine which was pulling a long line of freight cars up the eastern rise of the Great Divide. As it struggled with its burden up the long slope, it encouraged itself by repeating: "I think I can; I think I can; I think I can." As it approached the top it puffed and snorted and caught its breath and gasped once more: "I—Think—I—Can."

Then as it careened merrily down the western slope it chuckled to itself: "I thought I could; I thought I could; I thought I could."

For your relief and edification, I might say that in following my thought you have already reached the peak and if you can hold out for a few minutes more you will be able to join in chorus with the engine and say: "I thought I could; I thought I could; I thought I could."

We have traveled far in considering transportation surveys in connection with farm and forest, mine and quarry, steam and electric railways, and will close our inquiry by getting right down to cases and see what a survey can do for the individual business.

The hauling and delivery problem of every business should be surveyed in order that the most efficient means of transportation may be used, particularly with reference to highways. It is astonishing how little most concerns know about the cost of the delivery and hauling end of

their business. The concern that usually knows its labor, production, accounting and selling costs, has many times no idea of what its delivery cost is. Yet the delivery and hauling part of the business usually amounts to a great deal. A survey of such a problem will often indicate that it would be more economical to ship or deliver by motor truck than by horse-drawn vehicles, railroad freight or express, or by boat or electric railway. In considering a transportation system the nature and character of the business it serves should be considered first.

The proper kind of a survey will bring out all the items entering into the cost which would never be brought out in any other way. For instance, I had occasion the other day to make a survey of the shipping part of a business concerned with the rolling of steel products. This was a large concern with a railroad siding right into its plant. Its products take a very low freight rate and its deliveries are mostly to points located within sixty miles of the plant. Yet, this survey showed that the motor truck could be used to better advantage than the railroad, that it could transport material cheaper and exactly as it was wanted.

The survey developed, for example, that the average cost per box used to contain the material was $1.25 and that the average weight of these boxes was 42 pounds, something that the traffic manager of this concern had never considered before in his transport problem. Motor trucks are now being used by this company, thus releasing several freight cars for use where the railroad is the more economical means of transport.

The proper sized truck, the most adaptable kind of body, and the use of loading and unloading devices will many times serve to handle the hauling problem more economically and more efficiently.

Such a survey should take us behind the lines, so to speak—back of the loading platform into the shipping

room where we could consider such items as boxing, crating, sorting, assembling, routing, internal delivery, etc. It is here that, oftentimes, a study will show how the use of highway transport can cut down the cost of the work leading up to placing the material on the truck or on the car.

In making surveys relative to the establishment of highway freight transport lines, the following items should be carefully considered:

All-year-round road conditions, including bridges.
Rail freight and express rates.
Frequency of existing service.
Time of delivery of existing service.
Amount and kind of freight moving in both directions between the points in question.
Running time possible.
Sentiment of the district under consideration toward existing and proposed service.
Sufficient financial support.
Traffic laws, ordinances and regulations.

Road conditions will determine the kind of equipment that can be operated. The amount and kind of freight will determine the size of the unit, and number necessary, from which can be determined the expense, to which should be added (this is most often omitted) overhead charges, by which I mean the cost of soliciting business, storing and handling of same, superintendents, etc., which for such lines runs very high. The cost of operation will determine the rate. This compared with existing rates and services will determine whether or not business can be secured under such costs. The possibility of promoting return loads should not be forgotten. This, you will note, is quite different from the usual method of arbitrarily determining a rate, which is probably that charged

in some other locality and without knowledge of actual conditions.

In a survey recently made of the possibility of establishing inter-city motor truck routes out of a certain city, we concluded that the lowest capacity truck that could be operated, considering the rate that could be obtained, would be a three-ton size. Yet the operators disregarded our advice and started in with two-ton trucks. If loaded to 80 per cent. of their capacity on every trip, in both directions, they couldn't pay—and didn't—the result being the failure of another line and the loss of much confidence.

All this information is very easy to get if gone after in the proper way. Most communities now have commercial organizations which will be very glad to assist in the accumulation of such data.

Reliability in such service is absolutely necessary. In the case of highway passenger transport, the number of passengers will determine the seating capacity desired and the frequency of operation, which together with the length of haul will determine operating expenses and, therefore, the fare that must be charged. Here again reliable service must be inaugurated, as reliability is important in all transport matters.

There is no more important question before the public today than that of highway transport surveys and if this organization can succeed in putting some interest into this subject, it will have accomplished a big work.

CHAPTER IX

Bodies

Unless there is placed on the motor truck a body suitable to carry the commodity in sufficient bulk to equal the rated load capacity of the truck, arranged to permit quick loading and unloading, and designed to protect the commodity and also the truck mechanism from the commodity, if necessary, the truck itself cannot perform most efficiently and economically. So it has been said, and with much truth, that "a motor truck is only as efficient as its body."

Transporting ink in bulk this truck's power pumps the ink out and the engine's exhaust keeps the ink at a uniform temperature. The 1500 gallons can be pumped out in 20 minutes. This method will save the labor of 4 men. The truck will pay for itself in a year. If necessary the tank body can be removed and the chassis used for other purposes.

This fact is recognized to such an extent that even now, although truck operating efficiency is such a new art, almost every special line of business has developed to quite

a considerable extent, a motor truck body suitable to its own requirements. This development has come with the use of motor trucks, which permit more liberal dimensions and greater body weights than do horse drawn vehicles; and then again, the power of the truck engine can be utilized in many instances by designing bodies that will more efficiently handle some commodities.

Special motor truck bodies have been perfected to a large degree for use in the following lines of business:

Contracting	Ice cream
Lumber	Express
Meat	Railway terminal
Furniture	Inter-city hauling
Ice	Manufacturing—perishable
Coal	Manufacturing—non-perishable
Dairy	Department stores
Metal	Bottled goods
Baking	Moving
Electric railway	Farming
Telephone	Passenger transportation
Oil	Brick
	Municipal

It does not take much imagination to see that the commodities handled by this list of businesses, or lines of trade, vary to so great an extent that it is but natural that special bodies should be developed to meet their special requirements.

Yet, many purchasers of motor trucks have not considered the importance of the body in getting the most efficiency out of the truck. And so, many times, the truck itself has been blamed for not meeting expectations, when as a matter of fact, the body used has not permitted the truck to do its work properly.

We find that an inadequately designed body will allow a five ton capacity truck to carry but three tons, although

every foot of space in the body is occupied. And the contrary has also worked out, that is, that the body was so designed that when the space was entirely taken up, the

Truck with body arranged for making use of power developed by its engine for loading and unloading brick in neat piles. This saves breakages, space and time. Note that this device is adaptable to trucks of very small capacity.

weight of the load completely exceeded the capacity of the truck, thereby causing constant overloading with consequent frequent heavy repairs and a short life. Or, the body may be designed right insofar as weight and capacity are concerned, yet not designed so as to properly distribute the load on the chassis, thereby causing breakages.

A motor truck cannot earn money or perform service when it is standing still. Its fixed costs, that is interest on the investment, drivers' wagers, garage charges, etc., go on whether the truck is operating or not, and more inexpensive storage places than motor trucks can be found. Motor trucks earn money and perform transportation service only when they are actually transporting something. It is therefore necessary to keep them moving as much as possible, and the body design can help to speed up the

loading and unloading of the commodity which is being transported, and so be instrumental in cutting down the standing time. Doors properly placed, and of adequate dimensions, help this situation, as do racks and shelves arranged so that part of the load can be loaded or unloaded

Combination farm bodies make the truck more adaptable for farm usage where there are a variety of products of different character to be transported. The above pictures a combination body arranged as a "high grain tight body."

without having to shift the whole load. Devices attached to the body that permit the whole load to be loaded or unloaded all at once are particularly helpful, in the case of special commodities.

In the case of some commodities, the motor truck body must be designed to protect the commodity. It must be remembered that motor trucks are used instead of horse drawn vehicles because of their greater capacity, greater speed and greater range. In order to make full use of

these advantages, however, it is necessary in the handling of some commodities to provide a body that will give proper protection. For instance, it would be impossible to transport meats, ice cream, etc., over long distances where considerable time is consumed, without provision for cooling the commodity and keeping it cool. Again, special bodies must be designed for the transportation of

Combination farm body arranged for "stock," a water-tight underbody being a feature.

such fragile articles as glass and furniture, and to protect from those inclined to pilfer, such small and valuable articles as bolts of silk, etc.

Bodies are also designed actually to perform work, although they may not carry any commodity, except perhaps in the nature of equipment for repairs; such for instance as those bodies carried on chasses employed on electric railways and in the telephone service, and used in the repair and erection of overhead wires and poles.

Not only have bodies been worked out to suit the requirements of one particular line of business handling one kind of commodity, but bodies are also being designed now so that they can be adapted to handle several different

Combination farm body arranged to carry baskets.

commodities. The increasing use of the truck by farmers is perhaps more responsible for this development than anything else. Thus designs are now available so that, contained in one body, are arrangements so that the body can be made tight enough to carry grain, high enough to carry live stock, or arranged to carry baskets; and also provision has been made with a rack so that hay can be carried. Thus the farmer can use a truck equipped with such a body in different seasons and for his various products. Combination dump and platform bodies have also been worked out, as have tank bodies, so that oil or water can be carried and discharged as necessary.

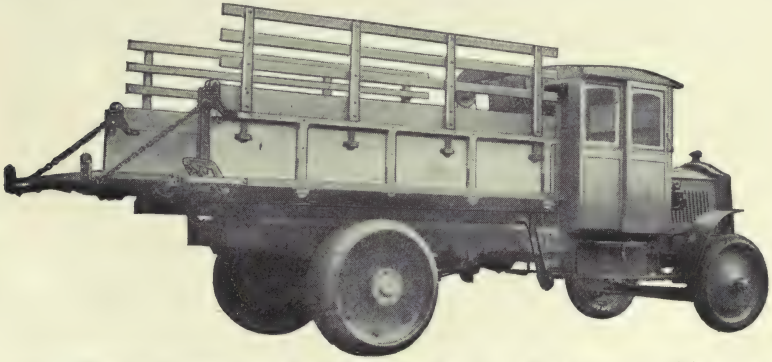
Important studies have been made in developing municipal motor truck bodies,—street flushers, road oilers, snow removers, sewer cleaners, ash removers, fire apparatus, etc. The motor truck has great potential possibilities along these lines.

Combination farm body arranged as a "low grain tight body." With the elevated sides lowered so as to be parallel with the floor of body it then becomes a "hay rack body."

The transportation of passengers by motor truck has also brought out several body designs, both of the single deck and double deck type, arranged for one-man as well as for two-man operation. No doubt, as the utility of the motor truck in this field of transportation is more and more recognized, further improvements may be looked for in bodies of this type.

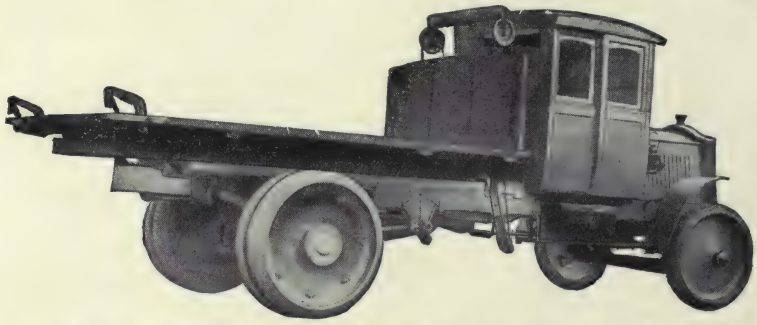
Combination contractors' body. This body enables the truck to be used for all kinds of construction work, thereby increasing its value. This illustrates the truck arranged as an ordinary dump body, the power of the truck being used to raise and lower the body.

There is another type of body the utility of which is only beginning to be recognized, that is destined to play a more and more important part in the whole field of transportation, and that is the removable or demountable type. In this type of body, body as well as load is removed at one



Combination contractors' body, arranged so that bulky commodities may be carried. The body, although arranged for dump work, is not confined to work of this kind.

time, thus cutting down the standing time of the truck chassis to the limit. The perfection and increasing use of this type of body is going to permit of the advantageous



Combination contractor's body arranged as a flat platform body, so that lumber, pipe, etc., can be easily carried and unloaded from either the rear or side of truck.

use of the motor truck in short haul work, and is destined to assist in reducing the enormous terminal costs of our railroads. This type of body, together with some others not here mentioned in very much detail, will be discussed in further detail in the next Chapter, which is devoted to loading and unloading devices, under which heading, perhaps, they more properly belong.

It should not be forgotten that motor truck bodies present an excellent opportunity to advertise the business that they serve, through either design, color, decoration, or finish. The concern not taking advantage of this phase of body work is perhaps losing a golden opportunity.

Perhaps the most common form of body is the ordinary platform type with removable stakes along the sides and rear. They are cheaper and can perhaps be used to transport a more varied line of commodities than can any other type. These bodies are used mostly in connection with general trucking and for the hauling of manufactured products. In these lines the bulk of the articles to be moved varies, and they need no special protection. In

their handling, the body itself can play little part in decreasing loading and unloading time except to give as much freedom as possible. In case the truck is called upon to handle products of a perishable nature, the body is usually provided with a top of some description.

In selecting a body, the weight, bulk, dimensions and character of the commodity should all be considered, as well as loading and unloading possibilities. These factors

This truck leaves little doubt in the mind of an observer as to the character of goods it is delivering.

have also a great deal to do with the capacity of truck selected; but in this latter determination the total daily tonnage and length of haul must also be considered, as well as road conditions.

It should be remembered that the designers of the truck chassis, in determining the capacity of the truck, provide for a body of a definite limiting stated allowable weight; which should not be exceeded if the rated capacity is to be used without overloading. Thus, for example, it is

usually permissible to use a body not to exceed 2500 pounds in weight on a five ton capacity truck.

It is impossible to describe and discuss in this limited book, every type of body already developed, or the possibilities along this line. The attempt has been made here simply to go into this part of the subject enough to have

A tank body used for transporting milk. It is filled through a pipe and unloaded by gravity through a pipe, thus eliminating the handling of cans, spilling of milk and trouble of covering cans during hot weather with wet canvas. The tank is provided with manhole for cleaning.

the reader realize the importance of and the possibilities in motor truck bodies, and their relation to motor truck transportation efficiency and economy.

Use should be made of developments already effected along these lines by the motor truck operator or the prospective operator; and he should recognize that with some study on his part and with an intimate knowledge of his

own product, his own loading and unloading facilities, and of his transportation problem in general, he can probably devise something novel to meet his own requirements. This the motor truck permits him to do. There is nothing cut and dried about it, and improvement after improvement is bound to be made; it is a flexible proposition all the way through, and herein lies its great possibilities and interest.

It is quite as important to pay attention to the selection of a motor truck body, as to the kind and size of chassis to be used.

CHAPTER X

Loading and Unloading Devices

A motor truck is earning money for its owner and performing an economical service only when it is actually moving,—when its wheels are rolling. Every minute that it is standing still during the working period means time and money lost compared with its earning power when its wheels are turning. Of course, the truck must be transporting something in order to perform a service. Of course, some time must be consumed in loading the commodity on to the truck, so that it can be transported; and in unloading it so that the commodity can be delivered and the truck freed for further service. The lower the loading and unloading time, the more trips a truck can make in a day. The more trips, the more tonnage; or with a gross tonnage, the truck can make longer trips; or by cutting down the wasted time it may be possible to eliminate a truck or two from a fleet of trucks.

Therefore the motor truck operator should carefully consider ways and means for cutting down loading and unloading time. In the previous chapter it was pointed out how the proper type of body would facilitate loading and unloading; but there are other devices as well that should be taken advantage of in obtaining economical and efficient truck operation. These devices group themselves quite naturally into four classes:

1. Those devices by means of which the whole truck load is loaded or unloaded at one time, en masse.
2. Those devices attached to the truck itself.
3. Those devices attached to the point of loading or unloading.
4. Those devices which are separate and movable.

LOADING AND UNLOADING DEVICES

In considering the subject of loading and unloading, it can be safely said that not only will these devices cut down the standing time of trucks, but that they will also reduce the *cost* of loading and unloading because of their ability to eliminate some of the manual labor, now so expensive.

Demountable or removable bodies, nest bodies, and semi-trailers are devices which may properly be considered as being in the first class referred to above.

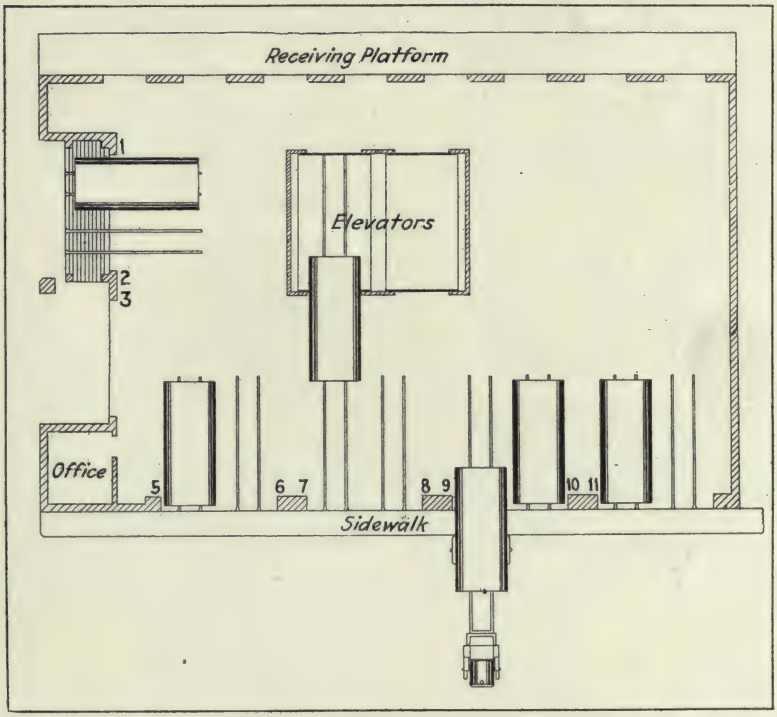
Perhaps the greatest development in removable bodies is the arrangement employed at the railroad terminals of one of the larger cities, and which was referred to in the last chapter, as a type of body destined to be of great service in railroad terminal work. With a removable body, the body and load together are lifted or rolled on to and off of the truck chassis, and the loading and unloading of the body accomplished later, but in the meantime, while this is going on, the truck is going on its way with another load in a removable body. It may take an hour to load or unload a body, depending on the character of the freight, how carefully it has to be stowed, etc., but it only takes a few moments to remove a loaded body from the chassis and to place another one thereon. The loading and unloading device in this instance merely consists of a traveling hoist, either hand-operated or electrically-operated.

Nest bodies are sometimes used with good effect when the commodity is light and consists of several small packages which take time to sort and pack properly. The packages are packed into a light body or cage supported on rollers; and when the packing is complete, the cage is rolled into the truck body, within which it fits, and rolled out of the truck body and on to the unloading platform at the other end of the route.

Although the semi-trailer also meets another transportation function as well, yet it can be included in the list of loading and unloading devices, because the hauling

A type of removable body that is just rolled on and off of the truck chassis. To have the loading platform the same level as the truck frame is the only real essential. It will pay shippers well to look into the lay-out of their loading and unloading platforms and coördinate them with their rolling equipment.

part of the transporting unit can be hauling another trailer while the first one is being loaded and unloaded, so that the hauling power plant is not tied up for the length of time necessary to load and unload.



The economic possibilities of removable bodies extend even beyond the truck and platform. With the kind that can be rolled off and on to the truck, the body can be rolled on to an elevator, rolled off at the topmost floor and loaded or unloaded at its farthest corner. Many expensive handlings can thus be saved.

In all three of these types of loading and unloading devices it should be noted that no labor is saved, their usefulness arising from the fact that the truck itself is standing still only long enough to place a body with its load on to the truck frame, or to attach it to the truck, or vice-versa. It should also be noted that with these devices special ar-

rangements must be provided at each end of the route, if the devices are to be fully taken advantage of. This is not necessary to merely perform the actual loading and unloading of the freight itself, because the truck, if necessary, can be kept standing and the freight taken out and put in, in the usual way.

The availability of the power of the truck engine makes it possible to equip the truck itself with loading and un-

Illustrating one advantage of a semi-trailer. The trailer is being unloaded of its fruit just brought in from the orchard, while tractor is actually doing work elsewhere. Note unloading device used to speed up unloading and to cut down the cost of labor.

loading devices which otherwise could not be taken advantage of. Thus, it is possible to install on the truck, power-driven auxiliary machinery, such as hoisting and pulling winches, cranes, suction pumps, dynamos, body elevating equipment, etc.

With the aid of winches and cranes, heavy and bulky

articles can be picked up, loaded and unloaded not only in a minimum of time, but also with a great saving in labor and auxiliary apparatus. By making use of the truck power it is possible, through the proper device, to create a suction which can draw up to the truck body the contents of catch basins and cesspools, or even to draw the ashes out of the basements of buildings. These devices not only cut down the time necessary to do such work, and eliminate much costly labor over the old method, but the

The overhead loading track and chain hoist with which this truck is equipped simplifies loading the truck with heavy materials.

motor truck enables it to be done in a manner less injurious to the health, not only of the operators but of the public as well.

A truck engine power-driven hoist also enables the truck body to be tipped at one end so that the material referred to above can be dumped all at once. Dump trucks so operated, but without the suction device, can also be used for unloading other materials, thus permitting a great saving in time and labor in unloading such commodities as coal, building and road making material, and so forth.

The engine of this truck loads it—

and then unloads it—saving time and money.

In order to show the large number of various uses to which the truck engine power or "power-take-off" as it is

Coal can be shot directly and quickly into the bin from a double lift body on a short wheel base truck. The short wheel base also enables the truck to maneuver in quarters so cramped that otherwise motor truck operation would be impossible.

known, can be put in facilitating loading and unloading, reference may be made to that by the ice dealer in icing freight cars. Refrigerating cars are usually iced from the top, and it has always been rather difficult to perform this work, especially when the cars are away from the permanent structures erected for this purpose. This ice dealer has a truck equipped so that the whole body can be elevated by the truck's own power to a level with the roof of the car, and then the ice is easily slid out through a door in the truck body to the opening in the car roof. With this device two men can easily and quickly ice a car.

In addition to the power-operated devices there are a

number of hand-operated devices that can also be taken advantage of to speed up loading and unloading.

With this elevating device, operated by the truck's power, one man can ice a refrigerating car, isolated from regular equipment for this work.

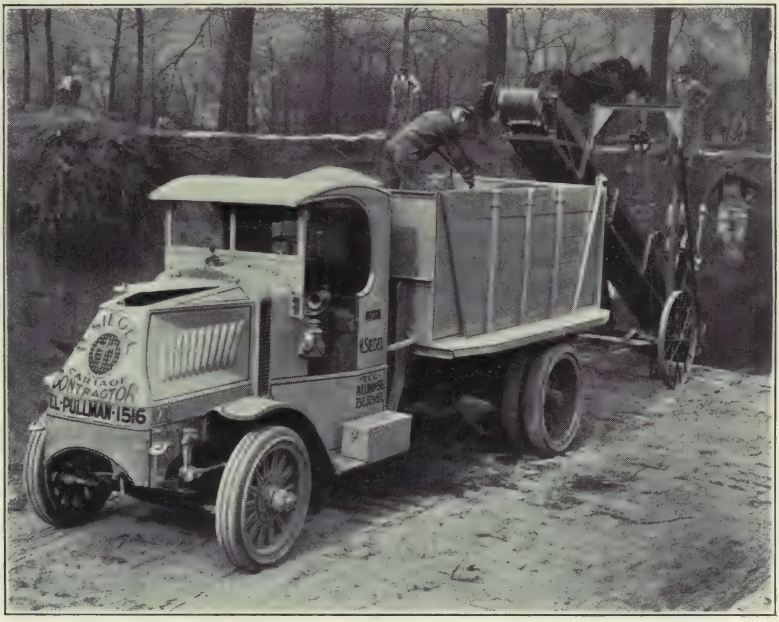
Among those devices falling into the third classification, or which are fixed to the loading and unloading points, are cranes and hoists of various descriptions, overhead conveyors, chutes, rollers, etc. These, where possible, should be arranged to load and unload directly from and into the truck.

Portable conveyors are now on the market, which can be had either air or electrically operated, and which have proven themselves to be of great utility in cutting down loading time. These conveyors can be placed alongside of a pile of coal, for instance, and without man power assistance load a five-ton truck in a few moments. Or they can be placed on a dock, or in the fields, or in the hold of a

A mechanical portable loader which not only saves money in actual loading but also loads quickly, thereby enabling the truck to make more trips per day.

vessel, and load bags or boxes in very fast time and with a great saving of labor.

No attempt has been made here to present in detail the whole subject of time and labor-saving motor truck loading and unloading devices, or to catalogue and describe all such devices in use or which might be used. A book could be written on this subject alone, although this phase of motor truck transportation is in its infancy. As the whole

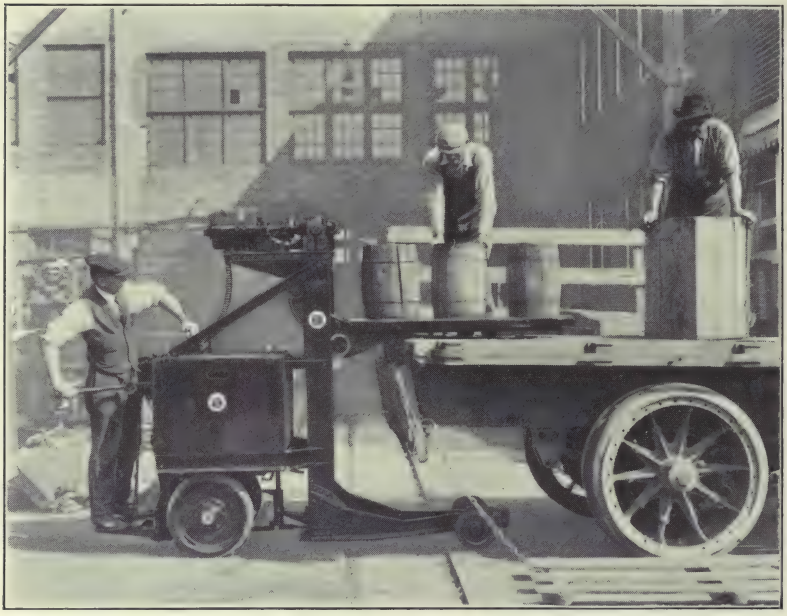


This automatic loader loads this ten-ton body in ten minutes.

science of this means of transportation develops, the more will be manifest the necessity for providing devices that will facilitate and cheapen loading and unloading. Further developments will be made along this line.

As the truck becomes known in new fields, or used to a larger extent in those fields in which it is already widely known, loading and unloading devices especially adapted to the particular work in hand will undoubtedly be de-

veloped. Thus, for instance, we may undoubtedly look for important developments in the use of the truck in the



A portable type of mechanical loading device which handles any kind of compact article. Such devices cut down labor costs and keep the truck rolling.

mining, lumbering, tobacco, sugar, cotton, road building, oil and other industries. The presence of the truck power plant makes it possible to develop many devices, isolated though the truck and its work may be.

The main point to be gotten out of this chapter is that the standing time of the truck should be cut down as much as possible. When the importance of this point is realized, the truck operator will be quick to utilize those devices already developed that can meet his requirements, or if there be none already in existence, to have one developed for him or to devise one himself, not forgetting the ability of the truck power plant to assist him.

Transferring a load of lumber from loading wagon, nicely piled onto a truck in from three to five minutes.

CHAPTER XI

Maintenance

A motor truck is a high grade piece of machinery and a very valuable piece as well, and it should be treated accordingly. It is impossible to obtain economy and efficiency of operation unless this fact is realized; and the degree of economy and efficiency obtained is dependent to a very large extent, larger than most people imagine, on the care given the truck and the manner in which it is operated.

Carelessly maintained and carelessly operated, the motor truck will depreciate more quickly than is necessary, —that is, its life will be shorter than it is built for and shorter than the operator expects,— and so the purchase price of the truck will be actually more than was paid, because what is actually purchased is mileage rather than a mechanical device. The truck's actual operating costs will be higher because of the number of unnecessary repairs; the whole cost of transportation will be higher than is necessary because careless handling produces major as well as minor repairs and the former lay the truck up for days at a time when hired equipment or some other supplemental form of transportation, at additional cost, must be resorted to; and direct operating costs will be higher because carelessness necessitates the use of more gasoline, oil, tires, and so forth.

Lack of proper lubrication, overloading, overspeeding, and lack of a systematic periodic inspection are the causes of rapid depreciation.

Lubrication of the truck is more important to proper maintenance than any other one thing. The truck manufacturer supplies a chart showing each part that needs lubrication, how often, and the type of lubricant to be used.

If these instructions are followed, and it is easy to do so, trouble from this source will be eliminated. In addition to increased wear on moving parts with lack of lubrication, because of such lack a truck may very easily become stalled on the road due to a burnt-out bearing or a seized piston.

Trucks are designed to carry certain stated loads, and if this load is exceeded, a strain is put on the parts, which of course shortens the life of the truck, even if actual breakages do not occur. Particularly is this true with respect to tires.

Trucks are also designed for certain maximum speeds, and in order to insure this, the engine is equipped with a "governor" which limits the speed. If this speed is exceeded, a strain is put upon the engine, because the number of revolutions per minute is increased beyond what the engine is designed and built for. The "governor" cannot however control coasting down hill at high speed; and if under these conditions the clutch is let in, the engine begins to work at a higher speed than is permissible. And even on the level it is not an uncommon practice for some truck drivers to open up the governor and "hit it up." Not only does over-speeding injure the engine, but all other moving parts use up lubrication faster than would be the case under a proper operating speed or that for which the truck was designed, and on which all lubrication instruction is based. Over-speeding also causes more wear and tear because of the increased jouncing, which may also result in damage to the load as well as to the road. Over-speeding also causes more wear on brakes and tires, and the accident hazard is very much increased.

The correct adjustment of the carburetor is important enough to be the means of saving many gallons of gasoline, and the correct position of the spark also has a bearing on full consumption, as have the brakes, which should be adjusted so that they do not drag.

Over-speeding, over-loading, rapid starts and stops, running over sharp objects, cartracks, etc., all shorten the life of tires.

In most instances it is the driver's duty to care for the truck in such matters as lubrication and minor adjustments, as well as to operate it. From all of this it will be seen that insofar as truck economy is concerned, the driver is somewhat in the key position. All of the time and most of the money that have been spent in selecting the size, make of truck and equipment best fitted for the particular work to be done, will be lost if a competent driver is not put behind the wheel. This is being recognized more and more, and to such an extent that many concerns have worked out bonus systems based on economies resulting from proper care and proper driving.

In using a bonus to increase efficiency, it is usually necessary to establish a standard, and then to pay a bonus to every driver doing better than the established standard. Thus, for instance, it may be established that in the particular line of work and for the particular sized truck considered, a certain number of miles per gallon of gasoline should in any event be expected. It could be arranged, then, to give in the way of a bonus, half of the cost of gasoline saved, if this standard is beaten. Or a bonus on tires could be arranged in much the same way. Experience would show that tires over certain routes and on certain sized trucks would last on the average a certain number of miles, and any driver doing better than this average would be entitled to a bonus. Standing time and repairs can similarly be cut down. Bonus systems can also be worked out on basis of the amount of actual work performed; as, for instance, the number of tons delivered, or gallons, or whatever the unit might be.

In addition to beating standards and particularly in the case of fleet operators, or where a number of trucks are being operated by one concern, contests can be arranged,

and the winner awarded a prize. Thus, a prize could be put up for the truck operating the most miles on a gallon of gasoline, or for the one doing the most work, or having the best appearance, or for keeping down repairs, etc. The important thing in contests of course is to be sure to have the conditions uniform.

The keeping of a proper cost accounting and truck performing record is very helpful in promoting truck driving efficiency. Such records compared one with the other, or with some known local standard, or with other trucks in a similar line, will invariably show whether or not the truck is operating efficiently, and steps can be taken to adjust matters accordingly.

Bonus systems, if properly conducted and under fair conditions, not only effect direct economies, but they make the driver concentrate on his work, and remind him that he has something which he himself can control for better or for worse. In other words, they should be designed primarily for securing the interest of the driver in his job rather than as a direct saving for the owner. Once this is accomplished, bonus systems are unnecessary.

Above all things, truck drivers should be selected with great care, not so much for their mechanical ability, as for their character, and they should be given a thorough training in the construction and operation of the truck. The driver should not only be drilled in how to drive the truck to the best advantage, but he should also be instructed as to how the mechanism works, and the reasons for having this and that on the truck, and just what abuse means.

The truck driver should be made as comfortable as possible. He should be protected in winter, and should have a comfortable seat, with electric lights if there is much night driving, and a self-starter if there are many stops. He should be supported by having his truck properly maintained and inspected.

Most truck manufacturers offer to inspect their trucks at

least once a month, either free or for a nominal fee. Taking advantage of this is one of the best insurances in economical truck operation; that is if it is followed up by the making of the necessary repairs. This method insures a happier driver, hence better work on his part; a safer vehicle and one not liable to frequent repairs and long overhauls. This method of keeping a truck and driver in prime condition is so logical that it seems a wonder that some operators allow a truck actually to break down before it is taken off the road for repairs.

The care and driving of the truck is an important item in motor truck transportation, but its importance is as yet little realized. When truck operators understand that they are handling an expensive piece of machinery, then only will they take the same care of it as is taken of locomotives; and then only will they see the economy of placing specially trained men in charge of the truck's operation. When that time does come, however, motor truck transportation will be on a higher economical plane than it is today. The human or personal element always counts, but in the operation of motor trucks it should be given a much higher rating than that now accorded to it.

Pick good men to be truck drivers. Train them properly; get their coöperation by taking them into some kind of partnership; give them good trucks to drive, comfortably arranged for the driver; and have the trucks properly and systematically inspected and the inspection recommendations carried out, and more efficient and more economical motor truck transportation is bound to result.

CHAPTER XII

Trailers and Semi-Trailers

A TRAILER is a vehicle with four wheels, which is attached to the rear of a truck, and is pulled along by the truck. A semi-trailer is a vehicle with two wheels, which is attached to the rear of a truck or a tractor, and is pulled along by it. Neither has any means of propulsion contained in itself. They trail along with the hauling device.

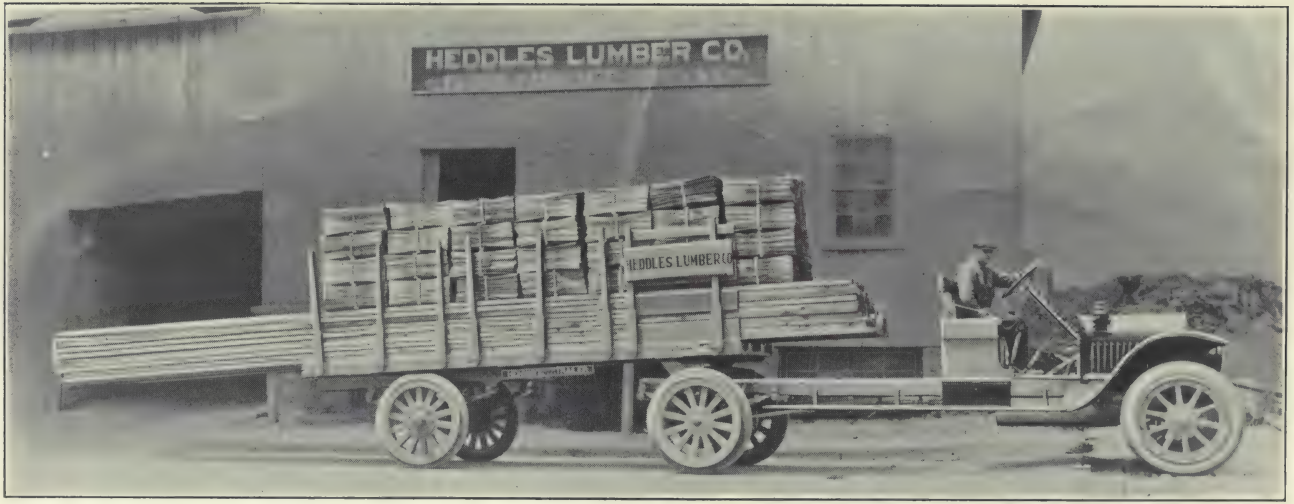
The utility of trailers and of semi-trailers is fast becoming known, with the result that their use has increased 100 per cent. in the last year. Their advantages are many, and when and where they can be used, it is economical motor truck transportation to use them.

It is possible, under the right operating conditions, to cut down the cost of highway transport by using trailers and semi-trailers. Anything that will do this deserves serious consideration.

The possibility of their use comes about because of the extra power and extra strength built into the truck when a truck is used as the hauling unit. Trucks are seldom used to haul semi-trailers. It is with the trailer that they usually furnish the hauling power, whereas semi-trailers are usually used in combination with tractors; a tractor being a device designed to pull a load and not to carry one. As used in highway transport work, the tractor closely resembles a truck.

A first class truck is designed and built to operate over bad roads, and to climb steep grades. Or, in other words, it is designed to meet severe road conditions. If, therefore, the use of a particular truck is confined to good roads, and moderate grades, its full power and strength are not called on and this excess power is known as "draw bar pull," or the pull that is left in the truck after it has started

This trailer train hauls milk 134 miles, cheaper, quicker and in better condition than was formerly done by railway express. The open trailer is picked up enroute and because of the shorter distance it is hauled and also because it is hauled at night the milk needs no refrigerating protection as in the case of the truck and first trailer.



Semi-trailers are used extensively in the lumber business, carrying loads impossible for trucks because of their length. The trailer is loaded while the tractor is busy hauling another trailer.

and moved itself plus its load. Obviously, it takes less power to start and move a load over hard surfaced roads, comparatively level than over soft roads, where the wheels sink in, and up grades. Where the truck is operating over level, hard roads, it is good business, because it is economy, to use the truck's excess power or "draw bar pull" in actually transporting an additional load by pulling a trailer, also loaded, if there is sufficient load to be moved at once, going in the same direction, greater than the capacity of the truck itself.

The principle that enables a motor truck, under certain conditions, to pull a greater load than it can carry, is the same as that which enables a man to pull more than he can carry, or a horse, or a locomotive, under certain conditions. We know that this is so with regard to the man, the horse, and the locomotive, not because of being convinced by either theory or figures, but because it is such a familiar sight, that explanation is unnecessary. And so it is bound to be with the motor truck and trailer. As the sight becomes more common, the fact will have to be accepted, even though it is not understood by everyone, and trailers will then be in more general use.

The economy in trailers lies in several directions. With their use, first cost in equipment is cut down, because generally speaking, and under conditions favorable to the use of trailers, a truck can pull a load at least equal to its own load, so that a five-ton truck can pull a five-ton trailer. As a five-ton trailer does not cost anywhere near as much as a five-ton truck (about one-third) there is this saving in equipment.

Although the carrying capacity is doubled, the operating expenses are not doubled by any means. Driver's wages, which is the biggest single item in truck operation, remains the same, since no additional help is necessary when a truck is used with a trailer.

The wear and tear on a trailer is very small, because there

are no moving mechanical devices contained within it, and hence, of course, depreciation is very low. The main item of wear and tear is on tires, and even these last longer on a trailer because there is not the tractive force expended on the tires of a trailer that there is on truck tires.

It is obvious that the lubrication and insurance items are very much less, as is also the interest charge, because of the very much lower first cost. Next to the driver's wages, the item of truck interest is usually the largest in an average day's work. If the daily mileage is very high, then the gasoline cost will exceed the interest cost.

It does, however, cost a little more to operate a truck in connection with a trailer, than if the truck were operated alone. It will probably take a little more gasoline, a little more lubrication, and there will be a little more wear and tear. There are no exact figures along these lines, but trailer operation will probably not increase the cost of operation over that necessary for the truck itself, more than 10 per cent. Some operators who have used trailers have made the statement to the author that it does not increase the cost of truck operation at all. Of course, this does not seem possible, and when pinned right down, these operators have not been keeping actual costs of truck operation without trailers and truck operation with trailers, so as to obtain true comparative costs.

Where trailers can be used to advantage, there is another saving, and that is in the cutting down of loading time. The more a truck can be kept moving, the more profitable it is, and the more it can be eliminated as a mere loading platform, the better. Trailers can sometimes be used to advantage in helping to keep the truck rolling, inasmuch as they can be loaded while the truck is making a trip. In other words, the expensive power plant is not being tied up. This is particularly advantageous in short hauls, where perhaps the loading time exceeds by a considerable period, the hauling time; whereas in long hauls, where the

A two-wheeled trailer. Small inexpensive trailers prevent truck overloading and solve the problem of fluctuating business.

loading time is a small percentage of the running time, the use of a trailer doubles the load that can be hauled.

In other words, particularly on a long haul, the greater the load, the less the expense per hundredweight or per ton, and if this load can be doubled by the use of trailers, with only a slight increase in the operating expense, and the initial investment, it is certainly good business to use them. As a matter of fact, if it was not for the practicability of trailers, a number of the so-called long distance motor transport lines could not live.

The use of trailers should also decrease the wear and tear on roads, thereby decreasing cost of highway maintenance and increasing the length of highway life, because every truck replaced by a trailer, takes just so much weight off the road. The weight of a trailer itself is very much less than the weight of a truck, and there is not as much tractive force expended on the road when using a truck and a trailer as there is when using two trucks.

Where the roads are particularly level, and hard, more than one trailer can be used, and of course where this is possible, the ton-mile costs will further decrease.

Trailers have as yet not made very much headway in districts where there are congested street traffic conditions, but it would seem that the use of trailers might tend to relieve traffic congestion. Certainly, with their use, two vehicles will occupy less space than two vehicles operated independently, and they will operate with better co-ordination. Trolley cars with trailers are now operating in many streets where it was formerly thought such an operation could not be carried on successfully, due to congested traffic conditions. There is no reason why motor trucks and trailers cannot be operated under such conditions with the same degree of facility.

The principle of the semi or two wheel trailer is somewhat different from that of the out-and-out four-wheel trailer. The hauling device in this instance does not it-

Semi-trailers are used to advantage in the logging industry.

self carry a load, and merely acts as a tractor, so that there is available all of the excess power over and above that necessary to move the tractor.

A tractor for highway transportation is practically a motor truck with a short wheelbase, and it may be stated that as a general proposition, that is on reasonably level roads with reasonably hard surfaces, the truck used as a tractor can haul a semi-trailer loaded to three times the rated capacity of the truck.

Where semi-trailers can be used, therefore, they are even more economical than trailers, because where a trailer is used, the truck ordinarily can only pull a load equal to its rated capacity; but of course the truck in this instance also carries a load. In other words, with trailer operation a truck can do twice as much work, whereas with semi-trailer operation it can do three times as much work, as if the truck is operated independently.

For instance, a two-ton truck operated without a trailing device of any kind can haul two tons. A two-ton truck operated in connection with a four-wheel trailer will haul four tons,—two tons on the truck itself, and two tons on the trailer. A two-ton truck acting as a tractor and hauling a semi-trailer, can haul six tons, none of which would be on the truck itself.

With the semi-trailer arrangement, as has been stated before, all the excess power in the truck is devoted to moving the semi-trailer. Furthermore, the truck acts as a support for the front end of the semi-trailer and so of course takes part of the load distribution. The space back of the driver's seat must thereby be utilized in connection with the supporting arrangement, which must be devised so that the semi-trailer can be quickly attached and detached, so that the load can be distributed to the best advantage, and so that the semi-trailer and tractor will be permitted to conform to all road unevenness without interfering with the stability of the semi-trailer.

This semi-trailer of large capacity is used as a store-house until fully loaded. In the meantime the tractor is hauling other trailers.

The economies already claimed for the four wheel trailer also hold good for the semi-trailer, in so far as cost of equipment and operating expenses are concerned.

There is undoubtedly greater economy in the use of a semi-trailer with respect to economy in loading and unloading; but in order to effect this economy, the hauling conditions must be particularly favorable to semi-trailer operation. The semi-trailer can be loading and unloading while the tractor is hauling some other semi-trailer. While the semi-trailer is being loaded and unloaded, the front end of course necessarily has to be supported by some other means, either on wooden horses or some other device, fastened to the semi-trailer, which can be arranged to support it when it is not in use with the tractor.

There is probably greater economy, in so far as the roads are concerned, by the use of semi-trailers than there is by using trucks independently operated or in connection with four wheel trailers, because the entire load is distributed over six wheels, and there need not be such a great proportion of it right over the driving units.

So far, it has been determined that comparatively level roads with good wearing surfaces are essential to successful trailer performance, and that a sufficient amount of freight, going in the same general direction, is necessary for trailer operation. Semi-trailer operation requires about the same road conditions, and the freight must be in such quantity or of such a character that the hauling unit can be kept busy while the semi-trailer is being loaded or unloaded. If there is no such hauling to be done, the unit employed in hauling a semi-trailer is for the time being a dead loss, whereas with a truck and trailer it is not necessary that there be sufficient freight to keep both truck and trailer busy whenever the truck is in operation, to make the investment worth while. The trailer is on hand when additional freight beyond the capacity of the truck has to be hauled. Trailer operation tends to cut down truck over-

loading, which is detrimental to the truck, as brought out in the chapter on Maintenance. If there is a trailer on hand it will be used rather than to try to put the excessive load on the truck itself.

If trailer operation is contemplated, the buyer should be sure of his equipment. There is undoubtedly an added strain placed on the truck, and one strong enough in every respect should be selected. There has been enough trailer experience now to show what trucks are standing up in this service. Inquiry on the part of the buyer will develop what make or makes to use. It is also important to select the right kind of an attaching device, one that can be depended upon to hold the trailer safely in place, and at the same time will be easily manipulated.

It is possible to estimate quite closely whether or not a given truck under given road conditions can pull a trailer of a given capacity, or what capacity trailer it can pull. In the first place, it is necessary to know the number of cylinders, their bore and stroke, the diameter of the rear wheels, and the gear reduction; with those factors known it is possible to figure the tractive power. The gear reduction can be taken at any speed, depending on the speed at which the draw bar pull is required. Ordinarily it is taken for high speed. Having found the truck's tractive force, it then becomes necessary to ascertain the excess available for trailer use. The difference between the truck's tractive force and the road resistance gives the draw bar pull available for trailers.

In order to determine the road resistance, the weight of the truck and of its load, the friction coefficient, and the per cent. of the ruling grade must be known. Having found the excess pull available, then by using the same friction coefficient and per cent. of grade, as were used in connection with the truck (they both of course traverse the same road) the trailer load that can be hauled can then be ascertained.

Formulae have been developed for use in obtaining this information, and there are tables available showing the friction coefficient for various types of road, so that it is not very difficult for the prospective trailer user to determine for himself at least approximately whether or not it is mechanically possible to use trailers or semi-trailers under the conditions presented in his hauling problem.

As trailers have been in use now for some time, however, under varying conditions and with many makes of trucks, it is perhaps better to have the truck manufacturer or the trailer manufacturer give concrete instances where trailers or semi-trailers are being used under conditions similar to those under consideration.

The use of trailers and semi-trailers in connection with motor truck transportation deserves serious consideration, and in studying any hauling problem, the practicability of their use should be considered, with the possibility of reducing actual operating costs, investment costs, standing time of the truck, street congestion, and wear and tear on roads.

CHAPTER XIII

Pneumatic Tires

Tires are used to protect the mechanism, the load and the road and to secure traction. Therefore the greater the cushioning powers of a tire, combined with durability and practicability, the more serviceable a motor truck can be made to become, because it can then make greater speed, thereby covering more miles per day without additional injury to mechanism and load, provided the mechanism effected by additional speed is designed to take care of it. The truck will also be enabled to extend its field by

Pneumatic tires enable the mail trucks to reach almost any point.

being able to travel over roads that may be impassable with solid tired equipment.

Although it is claimed by some, particularly some tire manufacturers, that trucks mounted on pneumatic tires can be operated more cheaply than those mounted on solid tires, there has hardly been enough experience as yet to determine whether this is actually so.

Turning back to Chapter II for a moment, we will recall that truck operating costs are divided into two main elements—fixed charges and variable charges. Tire equipment does not affect fixed charges except in the item of interest on investment. As pneumatic tired equipment costs more than solid tired equipment, this item is bound to be greater in its case. The cost of pneumatic tires themselves, together with the spare tires necessary to be carried if this kind of equipment is used, is three to five times more than the cost of a set of solid tires for the same truck. Other extra equipment is necessary, such as a mechanically operated tire pump, heavy jacks, etc. It also may be necessary to make changes in the chassis, adding to its cost, such as larger engines, greater braking capacity, a different gear ratio, a modified governor, cooling and lubricating system changes and longer springs, all perhaps necessary because of the greater speed permitted by pneumatic tires.

The items under variable charges are depreciation, gasoline and oil consumption, tires and maintenance. As has been said, claims have been made that the use of pneumatic tires effects a saving in all of these items. Although this may be so, there are as yet no figures covering operations widely applied over a long enough period, positively to substantiate these claims.

It is claimed that trucks so equipped will not depreciate as fast as solid tired equipment because the increased cushioning effect cuts down vibration and road shocks. On the other hand, because of the increased speed with which pneumatic tired equipment is generally operated,

there is probably greater wear and tear on the engine, on the lubricating and cooling systems, on the brakes, and on other moving parts. There is probably no saving in gasoline and oil in short hauls, whereas on long hauls there probably is, to some extent. Pneumatic tires probably

Pneumatic-tired tractors permit the hauling of long heavy articles over otherwise impassable roads. This tractor and semi-trailer is hauling pipe in the Texas oil fields.

wear out faster than solid tires and certainly cost more to keep in shape while they do last. Because of the increased speed there is probably no saving in general truck maintenance. Although there may be no saving effected by using pneumatics against solids in direct operating cost, mile for mile, pneumatic tires undoubtedly permit the use of trucks in some operations where solid tired trucks could not be used to advantage. For instance, over roads so soft that a solid tired truck could not obtain sufficient traction. Then, too, the pneumatic tire permits a greater speed, so

that a truck so equipped can reach out further in a given time.

When traffic and road conditions warrant, more trips per day can be made with pneumatics than with solids and so more ton-miles can be carried and consequently the cost per ton-mile will be lower. But this advantage should be considered along with the disadvantage that a truck so equipped, cannot be overloaded with the same degree of safety that a solid tired truck can. Careful as we may be, motor trucks will at times be overloaded.

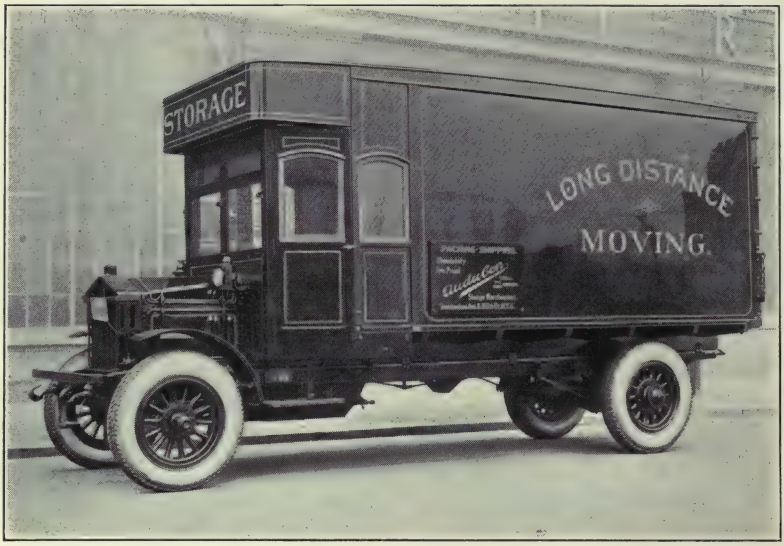
There is no "hard and fast" rule as yet developed as to when pneumatic tires can be used to advantage. The governing factors should be applied to the particular case in hand and then the equipment determined. Some of these factors are as follows:

Distance of haul.
Number of trips per day.
Speed of delivery.
Regularity of delivery.
Traffic congestion.
Condition of roads.
Tendency to overload.
Character of load.
Tire service stations.
Cost of operation.
Cost of maintenance.
Cost of substitute equipment.
Availability of substitute equipment.

Another thing to be considered is that pneumatic tires, because of their great size, raise the truck body higher off the ground, thereby making it, in some instances, more difficult to load. The turning radius is also somewhat increased.

There is, unquestionably, a field (and a very large one) for the pneumatic tired truck. They certainly can be

expected to increase the radius of truck operations, and they are to be recommended for hauling over bad roads or pavements, for off-the-road hauling (as in farms, orchards,



A typical long distance truck. Note the pneumatic tire equipment and protection for driver. There is also an overhead berth for the driver.

oil fields, lumber camps, etc.), for hauling fragile or perishable loads and for long distance hauling.

We have attempted to show throughout this book that the efficiency of a truck in performing its functions depends upon the amount of time and the amount of money that it saves. Oftentimes, truck operation may cost more than some other means of transport between given points, yet the saving in time alone by employing such operation may several times offset the increased cost of the operation itself; and so likewise the high initial cost of pneumatic tires may be offset by the increased radius of the truck, the greater number of trips per day, the faster transportation required by some commodities, etc., and there is no denying that pneumatic tires actually enable trucks to

operate to advantage over roads and under conditions where, before their use, truck operation was prohibited.

There is no advantage in using pneumatics in short haul work over city streets in congested traffic.

Pneumatics probably have a great economic advantage in that highways will stand up longer with their use, and this is an advantage that will not be overlooked.

Future developments in pneumatic tire construction and maintenance, and in chassis construction, will probably improve their availability to a point where they can be used to greater and greater advantage.

The potential advantages that exist for motor truck transportation in connection with the development of the pneumatic tire are so great that such developments should be encouraged in every possible way. They should not be limited to the construction of tires alone, but development should also be prosecuted just as vigorously in pneumatic truck tire maintenance and service facilities, and in adapting the chassis and body to utilize the advantages of pneumatics.

At present, at any rate, the truck capacity to which pneumatics can be advantageously applied is evidently limited to capacities up to and including three tons and one-half.

What has here been said applies to trucks only, and not to business cars or power wagons, as these latter are merely passenger car chasses with freight bodies, and their capacity does not exceed the carrying capacity of passenger cars.

CHAPTER XIV

The Motor Truck and the Farmer

One of the greatest beneficiaries of the motor truck is the farmer.

Perhaps the farmer's greatest problem, at the present time at any rate, is to obtain a greater price for his products. There is too great a difference between the farmer's selling price and the price which the consumer has to pay. There is too much handling, too much transportation, and there are too many middlemen. If the farmer can distribute direct to the consumer, he can obtain more and the consumer will pay less. The question therefore becomes a matter of distribution and the motor truck, because of its ability to transport quickly and economically direct from the fields and the orchards to the consumer's door, is now and is destined to become an increasingly important factor in the transportation of food-stuffs.

Good roads (which are coming in ever increasing length, there being available for this purpose this year over half a billion dollars); pneumatic tires, and trucks designed to get the most out of them in speed and traction; are being used and developed more and more; trailers and semi-trailers which increase tremendously the work one truck can do; special bodies and loading and unloading devices which keep the truck moving and save labor; coöperative movements in the farming and consuming districts; and a more sympathetic and a more efficient use and development (which are on their way) of the various national, state, county and municipal agencies, public and private; are some of the factors that are going to promote the more economical collection of, transportation of, and marketing of, all kinds of food-stuffs.

It will be noted then, that economical distribution =

Semi-trailer operation is found to be advantageous in the orchards. Speed is necessary to preserve the fruit and it comes with a rush. One tractor handles three semi-trailers, one trailer is being loaded in orchard, a second is enroute, while the third is being unloaded at packing house.

economical collection + economical transportation + economical marketing, and that economical transportation is the connecting link. It is being determined that the motor truck is in many instances the most economical connecting link and in many others, the only one.

The motor truck is increasing the farmer's profits, saving him money, increasing his markets, increasing his production, helping to solve his labor problem, increasing the value of his property, bringing him better roads and making life for himself and his family more pleasant.

Mr. Hoover said (and do we need to quote any greater authority on the distribution of food?):

"Fifty per cent. of our perishable foodstuffs never reach the consumer because the farms on which they are raised are too remote from the market at which they are sold.

"Forty to sixty per cent. of our potato crop is lost each year by rotting in the ground owing to poor transportation means, or spoiling on the way to market because of inadequate transportation over long distances.

"By motor trucks the farmer will be able to reach better markets farther away than now by horse and wagon. He will be able to spend more time actually producing on his farm and be able to sell food more cheaply by eliminating the present tremendous waste. By use of the motor truck the farmer will be able to produce more and sell at less cost."

The Bureau of Crop Estimates of the United States Department of Agriculture reports that hauling in wagons from farms to shipping points in 1918 averaged about thirty cents per ton mile for wheat, thirty-three cents for corn, and forty-eight cents for cotton. For hauling in motor truck, corresponding averages were fifteen cents, fifteen cents and eighteen cents—half the cost or less than half.

Not only does this reliable document report much lower ton-mile costs with the use of motor trucks but it also re-

Pneumatic-tired trucks are not only used to transport the products from the field, but are also used to "work the farm" when not in regular service.

ports that the motor truck haul from the farms to the shipping points averaged 11.3 miles, while wagon haul averaged only 9 miles. The motor truck, however, made on an average of 3.4 round trips per day over its longer route of 11.3 miles, while wagons made only 1.2 round trips per day over the 9 mile distance.

These authentic figures are a clear indication of the utility and value of motorizing the farm industry. The characteristic foresight of the American farmer will bring this about when he realizes (as he is doing more and more) that one truck on his farm will release several horses, that one horse requires five acres of tillable land to support it,—land which should be raising valuable foodstuffs required for human consumption, and that by the use of motor trucks he can haul to market while keeping his horses working in the fields; and that the motor truck will bring land, formerly too far from market for profitable farming, into good use.

As purely a means of transportation, motor trucks can be used in four ways to connect the farmer with his market:

1. By motor trucks owned and operated exclusively by the farmer himself.
2. By co-operatively owned trucks where the individual farm in the community does not have a sufficient amount of produce to support a truck.
3. By the establishment and use of regularly operated truck lines carrying food products at a regular scale of prices.
4. By the rural post trucks of the Postoffice Department.

All four ways are being successfully used. It is estimated that there are 100,000 trucks owned by farmers. There are several coöperatively operated farmer truck lines now in existence. The privately controlled Rural Motor Express is now a familiar sight in country districts, and the

Rural Post Trucks of the Post-office Department have carried on some noteworthy operations along this line.

In many instances, these Rural Express operations have been so successful that they have displaced short line railroads in the rural districts. In connection with this field

Patronizing the rural motor express. The availability of the motor truck is responsible for the successful inauguration of thousands of transportation lines in the country districts to the inestimable benefit of the farmer.

of operations no less an authority than Mr. C. A. Morse, a high railroad official, formerly of the Railroad Administration, has publicly stated that:

"Considered as a unit, practically none of the small branch railway lines feeding trunk lines pay expenses. The traffic gathered by them is turned over to the main line with a deficit attached, which has to be overcome during main line movement before any profit is made. It would be a decided advantage if this traffic could be delivered to the trunk line by means of motor truck."

The probable reason for this opinion is that the average length of the nearly seven hundred such railroads in the country is only about twenty five miles. The average haul is therefore only 12½ miles. This is so short that the motor truck can perform it more economically and at the same time give more frequent service. In any event, the farmer has to truck to the railroad car or the railroad platform. Inasmuch as the haul to the main line point of shipment is not very much further, it is better to continue the haul to that point thereby gaining more frequent service. Of course, because of the length of haul, this is impractical with horse drawn equipment, but it is entirely practicable with motor trucks. The motor truck can in many instances make the distance between the farm and main line shipping point in the same or in even better time than can the horse drawn vehicle make the distance from farm to branch railroad shipping point. In other words, the motor truck will be the feeder to railroads in rural districts.

Taking the official government figures already quoted it will be seen that the average daily distance traveled in the rural districts of the United States with horse-drawn wagons is about ten miles, whereas that with motor trucks is nearly forty miles, or nearly four times as great. This means that in such districts the motor truck can cover four times the distance a horse wagon can cover in the same time.

The farmer therefore might better take his motor truck and proceed to the main line, rather than use his horse to convey the products of his farm to the branch line. Remember, many farm products are perishable, or at any rate command a higher price when delivered fresh to the consumer. The farmer, too, in going to the main line shipping town is apt to find a market right there for part of his load; and moreover the greater opportunity for social intercourse that these visits to the larger towns affords is certainly apt to keep the farmer in a more contented frame of mind.

THE MOTOR TRUCK AND THE FARMER

The production and distribution of food stuffs is such a great national problem, that it has had the attention of governmental and state agencies; and their investigations show the advantages and disadvantages of motor trucks in such service. The results of these investigations can be obtained from the United States Department of Agriculture, from the United States Post-office Department, and from the various state departments of farms and markets. These reports and bulletins give much valuable information on how to organize rural motor express lines as well as farmers' coöperative motor truck lines, what factors to take into consideration, what kind of equipment to use, how to make rates, what kind of shipping papers to use, etc. See especially Bulletin No. 770 of the Bureau of Markets, United States Department of Agriculture, date May 5th, 1919, entitled "Motor Transportation for Rural Districts." Also, report with exhibits of the Fourth Assistant Postmaster General to the Postmaster General in December, 1919, showing results of operations of the motor vehicle truck routes of the post-office department. Also, Bulletin No. 931 United States Department of Agriculture, dated February 25, 1921.

These documents are noteworthy in that the first one describes in complete detail how to organize a rural motor truck route and the second gives actual results of such operations—not only actual costs of operations but also character and amount of commodities carried, as well as the savings made to the consumer.

No one should undertake the operation of motor express lines of any kind, either rural, inter-city, or urban, without having made a survey of the situation; and the ultimate decision should not be made until all the facts are in hand. This procedure has been explained in Chapter VIII, entitled "The Value of Highway Transport Surveys," but some of the points brought out there are important enough to be repeated.

Such a survey should take into account road and bridge conditions for every season of the year, the amount and character of freight that might be expected from the route in question, possibilities of return loads, length of haul, necessary frequency of operation and demand for the route in question. An analysis of this information will show in the first place whether or not a truck line is feasible; it will also show the number of trucks, their capacity and the type of body and kind of tires necessary to economically perform the hauling operation. Estimated costs of operation of the equipment necessary will then determine the rate which will have to be charged to cover expenses and a legitimate profit. The question then is—will the farmers pay this rate?—and the answer to this will depend on what he has to pay at the present time and whether or not he will receive superior service.

And so also should the transportation or delivery problem of the individual producer be carefully investigated before the kind of transportation to use is determined on. This idea has been expressed several times in this book and can be repeated again to advantage right here.

A farm is a producer, just as an industrial plant is a producer. The farmer has his shipping problems just as the manufacturer has, and the farmer should analyze his shipping and transportation problem just as the manufacturer does. Motor trucks are used by the manufacturer only because they increase the quantity of his production, decrease his production costs, or increase his selling price, through faster deliveries, etc. It is exactly so with the farmer; and as the farmer's products vary (the products of a farm are generally more diversified than those of any other industry) and also as his location, roads, lay-out of farm, and existing transportation varies, so does each individual farmer's transportation problem vary.

The farmer should attack his transportation problem with the single aim of using the most economical and most

Drug store supplies are a necessity and the motor truck solves this problem in the rural districts.

The interior arrangement of the truck is interesting.

efficient method, everything considered. He knows his present method but does he know whether or not it can be improved on? He may have studied it in connection with all existing means up to the advent of the most recent development and application of the motor truck, but has he taken this latest means of transportation and all of its features and applications under consideration? Does he know that pneumatic tires not only enable him to travel at any time of the year over roads hitherto in most seasons almost impassable, but also permit him to move faster than was possible with horses or with solid tired trucks? Does he realize that with the use of such equipment he may be able to do away with at least some of his horses; that it will give himself, or his help, more time on his farm actually producing; that it may enable him to get along with less help; that he can now get his products to market or to shipping point, when before he was held up entirely, or arrived too late to get the best prices? Does he know that he can reach markets which he could not reach before and so be more certain to dispose of all of his production probably at a better price? Does he realize that this means more contentment because of the greater social contact afforded himself and his family?

Does he know that motor truck bodies have been especially designed for him, even arranged so that one body can readily be converted into an entirely different one and then again into a different one still, so that on one trip he can carry live stock, on another, grain, and perhaps on the next all kinds of market produce; and yet another time, milk? Does he realize that with the motor truck he can go right into his fields, his orchards, his gravel pit, and his wood lot, and haul larger loads directly there and thence over the road?

Does he realize that with trailers and semi-trailers he can double and treble the increased amount of work one motor truck will do? And that with the power available on the

Pneumatic tires enable motor trucks to haul direct from the fields. If a mechanical loader had been used in this operation, the expense of two men would have been saved and the truck would not have been tied up so long.

motor truck he can do all sorts of things around the farm he formerly could not do and would have to pay some one to do for him?

Does the farmer realize that the motor truck can be a profitable piece of machinery on the farm as well as on the road?

Unless the farmer has considered all of these points and others not mentioned, which will occur to him when he really begins to think this thing through, he cannot say whether or not he is using the most economical transportation methods on and off of his farm.

And so it cannot be stated until all the conditions are known whether or not a farmer can use a motor truck to advantage; and if he can, what kind of equipment he should use; that is—what capacity truck, what kind of a body, what loading devices, whether the truck should be equipped with solid or pneumatic tires, etc.

What has already been said in the previous chapters about costs, laws of transportation, surveys, bodies, loading and unloading devices, maintenance, trailers and semi-trailers, pneumatic tires, roads, etc., applies just as emphatically to the motor truck applied to the farm as it does to its application in any other transportation, delivery or hauling or production problem.

We know that in many instance horses and railways are the things to stick to. It cannot be said that in every instance or on every farm the motor truck is the best method of transportation to use; but it can be contended that the farmer owes it to himself to make a real investigation before he rests satisfied with the way he is handling the situation.

CHAPTER XV

Good Roads

The road is to the motor truck what the track is to the railroad train. Without a track of adequate strength and dimensions it would be impossible for our railroads to operate with the present degree of efficiency. As the weight, size and speed of cars, trains, and locomotives has increased, so also has the weight, size and strength of the tracks been increased and maintained with more care. Without a sufficient number of adequate tracks, the railroads of this country could not begin to serve the important points. No matter how many railroad lines we have, they will not perform transportation service in its entirety. We must still look to the highway. Former Secretary of Commerce Redfield has said: "You might build up the railroads until they are ten tracks wide, and fill the rivers with steamers, and still the farmer could not be served."

It is well to recall that our first railroad tracks consisted simply of wooden beams surfaced with a strap of iron. Although the first railroad in this country, the Baltimore and Ohio, began construction in 1828, the first T-rail made of steel did not make its appearance until 1863. Such rails were first imported from England. They were not manufactured in the United States until 1865. The first T-rails were made of iron, were but sixteen feet long, and weighed but thirty-six pounds to the yard. Rails in this country now are as long as 60 feet and weigh as much as 125 pounds to the yard. The tremendous increases in the weight of cars and engines and in the speed of trains have necessitated this great increase in the weight of the rails, together with even greater improvements in the foundation on which the rail rests.

As the railroad has developed, it has been found that transportation costs could be cut, or at least prevented from rising to a prohibitive degree, by increasing the size of the cars, the length of the trains, and the operating speed; and this of course has necessitated an increase in size of the locomotive because of the additional power and traction necessary to do the heavier work. It is significant to note that the first locomotives built in this country weighed but 3½ tons and that the first freight cars had a capacity of but 3 to 5 tons. Today there are locomotives weighing as much as 400 tons and there are freight cars of 60 tons capacity. It is also interesting to note that there are 2,400,000 freight cars and 900,000 motor trucks now in service, it has taken nearly 100 years to develop 2,400,000 freight cars and but 10 years to develop the use of 900,000 motor trucks. The weight and capacity of the motor truck are already more than double the weight and capacity of the first locomotives and freight cars, and yet the number of miles of highway that are in any way improved, in this country, is less than half the number of miles of railroad. The number of miles of highway that are suitably improved to sustain heavy motor truck traffic is a ridiculously small percentage of the railroad mileage.

Despite the fact that proper and sufficient highways do not exist, motor truck transportation has increased and is increasing faster than any other method of transportation. There can be but one reason for such a condition; and that is, that the motor truck has such an important and economic place in our distribution system that despite the lack of one of its most important and necessary essentials, its application is making great headway. If this is so (and no one can dispute it), it is something more than short sightedness not to provide for the economic use of the truck. This is being recognized and great headway is being made in proper highway construction. Within the last few years, nearly every state in the Union has voted a large

bond issue, the proceeds of which are to be used for highway construction. Within the last few years, the Federal Government itself has appropriated monies to be used with the states for this purpose. The important thing and the the thing to instill into the minds of people is to ensure that these large sums of money are spent for the construction of the right kind of highways and along routes that will do the most good. It is especially important that proper provision be made for their upkeep, once the highways are constructed. How long would railroad tracks last if they were not properly maintained? If they are not properly maintained, how long would the rolling stock last?

The present Federal aid laws do not provide for maintaining the highways once they are built, nor do these laws provide that proper consideration be given the routes over which Federal aid highways should be built. To correct this situation, Senator Townsend of Michigan, more than two years ago, introduced a bill providing for a system of highways to be built according to the present and future demands of traffic and also for maintaining such a system. Although this bill had unusual support, the exigencies of politics prevented it from getting very far. That some such bill will be passed and made operative in the near future is indicated by what President Harding had to say in his message to the joint session of the 67th Congress, on April 12, 1921. On that occasion President Harding, in this connection, said:

"Transportation over the highways is little less important, but the problems relate to construction and development and deserve your most earnest attention, because we are laying a foundation for a long time to come and the creation is very difficult to visualize in its great possibilities.

"The highways are not only feeders to the railroads and

afford relief from their local burdens; they are actually lines of motor traffic in interstate commerce. They are the smaller arteries of the larger portion of our commerce and the motor car has become an indispensable instrument in our political, social and industrial life.

"There is begun a new era in highway construction, the outlay for which runs far into hundreds of millions of dollars. Bond issues by road districts, counties and states mount to enormous figures, and the country is facing such an outlay that it is vital that every effort shall be directed against wasted effort and unjustifiable expenditure.

"The Federal Government can place no inhibition on the expenditure in the several States, but since Congress has embarked upon a policy of assisting the States in highway improvement, wisely, I believe, it can assert a wholly becoming influence in shaping policy.

"With the principle of Federal participation acceptably established, probably never to be abandoned, it is important to exert Federal influence in developing comprehensive plans looking to the promotion of commerce and apply our expenditures in the surest way to guarantee a public return for money expended.

"Large Federal outlay demands a Federal voice in the programme of expenditure. Congress cannot justify a mere gift from the Federal purse to the several States, to be pro-rated among counties for road betterment. Such a course will invite abuses which it were better to guard against in the beginning.

"The laws governing Federal aid should be amended and strengthened. The Federal agency of an administration should be elevated to the importance and invested with authority comparable to the work before it. And Congress ought to prescribe conditions to Federal appropriations which will necessitate a consistent programme of uniformity which will justify the Federal outlay.

"I know of nothing more shocking than the millions of

public funds wasted in improved highways—wasted because there is no policy of maintenance. The neglect is not universal, but it is very near it. There is nothing the Congress can do more effectively to end this shocking waste than to condition all Federal aid on provisions for maintenance. Highways, no matter how generous the outlay for constructions, cannot be maintained without patrol and constant repair. Such conditions insisted upon in the grant of Federal aid will safeguard the public which pays, and guard the Federal Government against political abuses, which tend to defeat the very purposes for which we authorize Federal expenditure."

England and France have excellent highway systems, because in the first place, they were laid out with respect to the demands of traffic; they were constructed of sufficient strength and width, and properly designed to meet the needs of whatever traffic they were called upon to bear; and once constructed they have been properly maintained. Why it is that this country cannot benefit from the experience others have had in this connection may probably be charged to the general wastefulness of the people of the United States, to our lack of planning and to our political system which makes experts over night. But the motor vehicle has proven to be such a necessary means of transport that wastefulness must be eliminated, routes planned with respect to present and future traffic, and economical business methods universally adopted in connection with the construction of highways, if we are to get the most out of this new means of transport.

The roads of England and France are generally better designed than are our roads; better materials and better workmanship are as a rule put into them; the roads to be improved have been determined by an analysis of traffic requirements and the character of traffic, which analysis has also determined the material and type of construction used. The "traffic census" is the usual thing in these

countries. Once roads are improved, the patrol or constant system of maintenance is used. Defects and first appearances of wear are immediately taken care of. Yet with this system of acquiring adequate roads, and with the real knowledge that these countries have of roads, they continue to make actual service experiments. It is pleasing to note that our own Bureau of Public Roads is making progress along these lines and it is also gratifying to know that the Lincoln Highway Association has determined to construct an "Ideal Section" along that highway; and that the type of construction, materials to be used, the dimensions, and character of foundation have been selected by a committee of highway engineers. The effort, of course, is to determine how and of what materials the ideal road in this country should be built.

Motor vehicle manufacturers and allied manufacturers have done a great deal to help the highway situation by designing their products to meet the conditions presented and to protect the highways. They must keep up and improve in this work. Unsprung weight is being decreased, better springs designed, truck speed is being mechanically limited, loads are being more evenly distributed, and more resilient tires are being developed. All of this tends to decrease the wear and tear on the highways as well as on the truck itself.

But the highways must be constructed (within economic limits) to withstand the traffic offered them. They must be the servants of whatever vehicular traffic is found to be of economical service, all conditions considered, and must not be the masters of such traffic. Can it be conceived by any stretch of the imagination that the country would have developed as it has if the rails themselves had set the pace for railroad development? How far developed would the country be today and how very much more expensive distribution would be, if we were still confined to small sized locomotives, freight cars and trains, with their

limited speed? The economy due to larger railroad equipment and increased speed very much more than overcomes the increased cost of heavier tracks, better maintained. And so it is with motor trucks and highways. We are learning that with smooth, wide highways of sufficient thickness, built of enduring material on well protected foundations, with severe grades eliminated and curves amply protected, all properly maintained in good order, the motor vehicle can be operated with enough additional economy to justify the additional first cost and maintenance charges necessary to establish such highways; provided they are laid out to be real routes of communication.

Such highways permit of the use of greater carrying capacity trucks, more mileage per day with each such truck with greater safety, less wear and tear on the truck as well as on the road, and less fuel consumption. It is not necessary to present figures to prove this. It is self-evident. The point to be determined is, just what the economical limits are in road design and cost of materials of construction. Some headway is being made in this respect, and with a more energetic interest on the part of the public and of the authorities, as is now forecasted, a still greater advance can be safely predicted.

The laws of motor truck transportation (as applied to operating costs), which have been given in Chapter III, show that the cost per unit-mile (per ton-mile, etc.) will vary with different capacities and with the miles of truck haul per day. This cost will *decrease* as the capacity increases and it will *decrease* with an increase in daily mileage. A road that will permit of the use of large capacity trucks operating at high speed (which of course means more miles per day) is the road that will lower ton-mile costs. And if such a road is built in the first place in such a way and of such materials to endure without much maintenance expenditure, and if the attention which is required is

properly provided, the savings to the community will more than justify such construction; provided always that there is enough traffic to warrant such construction, or that enough traffic can be created.

We have seen in Chapter XII on Trailers and Semi-trailers, how this form of equipment can materially help to reduce hauling costs, by utilizing the full power of the truck. We should remember that these devices cannot be fully utilized unless road conditions are good; that is, unless the roads are hard and reasonably level.

Economic motor truck transportation is so involved with the question of good roads and their maintenance, that full advantage of this means of transportation cannot be taken, unless the subject of roads is broadly and wisely considered in every detail. The community that does not provide good roads, adequately maintained, is going to suffer in the future, just as much as though it did not have immediate contact with railroads. It therefore behooves those interested, not only in distribution, but also in the cost of Federal, State and County government (and between these interests every one is included) to take a lively interest in the subject of real highways, properly maintained.

The social advantages of good roads are not fully understood and yet they are very great. They make personal communication and contact, in those districts where the highway must be depended upon for this, very much easier and consequently more frequent. The value of such advantage cannot be overestimated. The economic advantages are even less understood, because to prove this absolutely, figures are necessary; and unfortunately there are no figures at hand to show such benefits in a way that can be grasped by the general public. When the actual money benefits of good roads can be interpreted in simple terms that can be easily grasped by any one, there is no doubt that an even greater demand than now exists will

be made for good roads, and this demand will carry with it the further demand that the roads be properly laid out, constructed and maintained.

We need more of the kind of information that was presented in the Engineering News-Record by John C. Veenbruyzen, Superintendent, Los Angeles County Road Department, Los Angeles, California. (California has made rapid strides in good road construction and probably has more mileage of real, hard surfaced, durable roads than any other state.)

In this article Mr. Veenbruyzen presents actual figures to substantiate the deduction made, at least in the case he presents, that "Good Roads Pay for Themselves Twice Every Year." The figures presented included total investment for the roads under construction; that is, original cost and maintenance costs up to date; and operating income based on the number of vehicles using the roads, multiplied by a conservative estimate of the saving in ton-mile haulage costs per vehicle, based on haulage charges. A period of four years is taken: and these figures show conclusively that the saving in cost of haulage over these roads paid for them nine times in the four years.

The opening paragraphs of this article are as follows:

"Comparison of accurate traffic censuses with haulage contract prices over both improved and unimproved roads in Los Angeles County, California, shows highway improvements to be a great economic investment. According to the data available as to the saving in haulage per ton-mile, to date three of the main roads out of Los Angeles have paid for their original cost and maintenance about nine times during the past four years. While it is impossible to estimate some of the indirect saving and other advantages from such improvement, the actual saving in transportation amply justifies large expenditures for this purpose, and it is believed that if such figures as are here

presented are made public, there will be no trouble in obtaining money for such construction.

"In general, the public is most interested in the original cost of such improvements, and although to a certain extent it is realized that they are a benefit to the community, still the public does not fully realize what the actual benefit is because there are no figures at hand to show this benefit in a form that can be grasped generally. Indeed, it is doubted whether the persons most interested in the subject —that is, those who create the traffic by the use of such roads for their daily work or pleasure—fully realize the economy which is the result of the improvement and to what extent they profit.

"It will therefore not be out of place to give some detailed figures, the result of nearly five years of investigation, which express what might be called the 'operative income' of good roads, . . . "

And then the article goes on to analyze the figures given and arrives at the above conclusions.

Three different roads are taken, aggregating forty-three miles in length, which cost when they were built in 1911, 1912, and 1913, $670,801.00, and which have cost $522,-343.00 to maintain up to and including 1918: so that the total cost up to that time was $1,192,144.00. The total operative income for the four years of 1915, 1916, 1917 and 1918 is given as $10,718,646.30; or in other words, the roads paid for themselves nine times in the four years, or they actually paid for themselves, in the reduction of haulage charge, within six months.

It is interesting to note that the maintenance charges on these roads had about equalled their cost in seven years: and as the motor truck traffic alone was heavy (about 10,000,000 trucks a year) the question may be raised whether it would not have paid to have put down a more durable and more rigid pavement in the first place. This

could probably have been done at that time for less than the total cost of the softer and less endurable road, and with less annoyance to traffic through maintenance delays. The answer to this is however that when these roads were planned and built, motor trucks were not anticipated in any such number as now exist, and not so much was known about the kind of road to put under them as is now known. Again, it may have been the old story of first cost.

In connection with this subject of motor trucks and road maintenance the experience that New York State is having is significant and impressive. This experience is concisely put in the 1919 annual report of Frederick S. Green, New York State Commissioner of Highways for that year. Mr. Green reports under "Permanent Pavements" as follows:

"Upon taking office, the present Commission was astonished to find how large a sum is now required to maintain our highways. Realizing that this expenditure will increase rapidly with both the increased age and mileage of our improved roads, a study of maintenance was made from Department records which led to a definite and undeniable conclusion: Many of the highways as constructed in the past were not designed with sufficient strength to carry present day traffic. The advent of the motor truck has made the building of more permanent type of pavement an economical necessity. That truck traffic is but in its infancy, and will be doubled and trebled during the next decade, is confidently predicted by the users and manufacturers of these vehicles.

"In round numbers it is now costing the State $1,000 per mile per year to keep the lighter types of pavement in usable condition, whereas experience shows that by building a stronger pavement at a slightly greater initial cost, this maintenance charge will be reduced to not more than $200 per mile per year. Department records further show

that these light pavements go to pieces in from seven to ten years, making reconstruction necessary. We believe that pavements constructed upon a better foundation and of a more durable material, will last 25 years or longer."

The New York *Sun* probably expressed the growing public opinion on the subject of motor trucks and highways in a recent editorial entitled "New Freight Carriers," reading as follows:

"After the signing of the armistice an extensive reduction in the volume of freight moved in this country was expected by many to render unnecessary the practice of long-distance hauling with motor trucks. Yet today not only does the truck hold its own as a freight carrier, but it even gains in some sections, for some uses.

"Reliable statistics show that some 1,100 trucks, engaged in long distance hauling, enter Manhattan every day from the New Jersey side alone. The movement of goods between Boston, Hartford and Springfield is said to approximate daily 300,000 pounds. From Los Angeles as a center 600 trucks serve the whole of southern California, distributing merchandise to the farmers for many miles around and bringing back in return agricultural products for railroad shipment or consumption in the city.

"Unfortunately this new movement for its maximum development requires nothing less than the reconstruction of the entire system of national highways. Heavy trucks soon pound the old macadam roads to pieces and nothing short of the firmest seems adequate to their needs. Some States have met the situation by prohibiting the operation of trucks of a certain tonnage over the highways. But others, taking a more daring view of the opportunities and requirements of the situation, have undertaken to provide the proper roads for long distance traffic.

"The Highway Commission of California plans to spend

$12,000,000 a year on road work, while some fifteen Southern or Southwestern States have appropriated large sums for a like purpose.

"In short, the motor truck has inaugurated a new era in transportation. It seems most unlikely that this carrier will ever supersede the railway to anything like the extent to which, for instance, the railway superseded the canal, but it has already claimed for itself a share in traffic of a certain sort. It bids fair, as time passes, to win more than it has yet got. The State which fails to realize that long distance truck hauling has come to stay and neglects to provide for it suitable highways may suffer for its lack of foresight, by lost opportunities."